U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DIVISION

FINAL SITE-WIDE HYDROGEOLOGY REPORT

FORMER RARITAN ARSENAL
PHASE 2
REMEDIAL INVESTIGATION

VOLUME 1 OF 3

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TABLE OF CONTENTS
VOLUME 1

WESTON MANAGERS DESIGNERS/CONSULTANTS

TABLE OF CONTENTS (CONTINUED)

WESTON MANAGERS DESIGNERS CONSULTANTS

TABLE OF CONTENTS (CONTINUED)

WESTON

TABLE OF CONTENTS (CONTINUED)

WESTON
MANAGERS DESIGNERS CONSULTANTS

TABLE OF CONTENTS (CONTINUED)

Section	Title	Page

WESTON
MANAGERS DESIGNERS CONSULTANTS

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES (CONTINUED)

WESTON MANAGERS DESIGNERS/CONSULTANTS

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES (CONTINUED)

WESTON MANAGERS DESIGNERS/CONSULTANTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES (CONTINUED)

WESTON MANAGERS DESIGNERS/CONSULTANTS

TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES (CONTINUED)

WESTON MANAGERS DESIGNERS/CONSULTANTS

TABLE OF CONTENTS (CONTINUED)

VOLUME 2
LIST OF APPENDICES

VOLUME 3

LIST OF APPENDICES

WESTON MANAGERS DESIGNERS CONSULTANTS

TABLE OF CONTENTS (CONTINUED)

LIST OF ABBREVIATIONS

AGS - Aboveground Surface
AOC - Area of Concern
ATV - All Terrain Vehicle
BRK - Bedrock
CaPAH - Carcinogenic Polyaromatic Hydrocarbons
CDAP - Chemical Data Acquisition Plan
CW - Chemical Warfare
DERP - Defense Environmental Restoration Program
DOD - Department of Defense
EODT - Explosives Ordnance Demolition Technology, Inc.
FBC - Federal Business Centers
Former Arsenal - Former Raritan Arsenal
FS - Feasibility Study
FUDS - Formerly Used Defense Sites
GDMS - GEOLIS Data Management Software
GEOLIS - Geologic Logging and Interpretation System
GSA - General Services Administration
HTW - Hazardous and Toxic Waste
IT - International Technologies Corporation
KCD - Kansas City District
LEAD - Letterkenny Army Depot
LHRA - Limited Health Risk Assessment
LS - Lower Sand Unit
MCC - Middlesex County College
MCMC - Middlesex County Mosquito Commission
MCUA - Middlesex County Utilities Authority
MGD - Million Gallons Per Day
mL - Milliliters
mm - Millimeters
MM - Meadowmat Unit
MRD - Missouri River Division
MS - Matrix Spike
MSD - Matrix Spike Duplicate
MSL - Mean Sea Level
mya - Million Years Ago
NED - New England Division

WESTON MANAGERS DESIGNERS/CONSULTANTS

TABLE OF CONTENTS (CONTINUED)

LIST OF ABBREVIATIONS

NGVD - National Geodetic Verticle Datum
NJDEP - New Jersey Department of Environmental Protection
NTU - Nephelometric Turbidity Units
O.D. - Outside Diameter
OBG - O'Brien & Gere
OEW - Ordnance and Explosive Wastes
PAL - Palisades Sill Formation
PAS - Passaic Formation
PCB - Polychlorinated Biphenyls
PID - Photoionization Detector
PPB - Parts Per Billion
ppm - Parts Per Million
PPM - Priority Pollutant Metals plus Barium
ppt - Parts Per Thousand
PVC - Poly Vinyl Chloride
QA - Quality Assurance
QC - Quality Control
RD - Remedial Design
RI - Remedial Investigation
ROI - Report of Investigation
RQD - Rock Quality Designation
SCS - Soil Conservation Service
SG - Staff Gauge
SGWS - Shallow Groundwater Screening
SI - Site Investigation
SOW - Scope of Work
Summit - Summit Associates Inc.
SVOC - Semivolatile Organic Compounds
TAL - Target Analyte List
TCL - Target Contaminant List
TDMS - Technical Data Management System
TDS - Total Dissolved Solids
TNT - 2,4,6-trinitrotoluene
TOC - Top of (inner PVC) Casing
TPHC - Total Petroleum Hydrocarbons
US - Upper Sand Unit
USACE - United States Army Corps of Engineers

TABLE OF CONTENTS (CONTINUED)

LIST OF ABBREVIATIONS

USCS - United Soil Classification System
USDA - United States Department of Agriculture
USEPA - United States Environmental Protection Agency
UXB - UXB International
UXO - Unexploded Ordnance
VOC - Volatile Organic Compounds
WBK - Weathered Bedrock Group
WWTP - Wastewater Treatment Plant

EXECUTIVE SUMMARY

This report presents the results of the site-wide hydrogeologic investigation performed at the former Raritan Arsenal from June 1993 through March 1995 as part of the WESTON Phase 2 Remedial Investigation (RI). The objectives of this report are to: (1) summarize the results of the physical site characterization investigation, which included a supplemental geologic/hydrogeologic investigation and surrounding well use survey; (2) present the results of background and site-wide groundwater sampling conducted during November and December 1994; and (3) identify potential contaminants of concern, as well as their potential sources and migration pathways in groundwater. Results of surficial and subsurficial soil sampling and surface water and sediment investigations are presented related to specific groundwater areas of concern; however, detailed results for these matrices are presented in separate reports.

The results of the Phase 2 RI indicate that most of the southern two thirds of the former Arsenal consists of a lowland estuarine environment, while most portions of the northern third of the site are either developed or freshwater forested and emergent wetlands. The site topography slopes gently east-southeast towards the Raritan River. The site geology is characterized by an overburden layer, approximately 10 to 80 feet thick, composed of unconsolidated sediments underlain by a bedrock (Passaic and Palisades Sill Formations) composed of shales, metamorphosed shales and an igneous diabase sill. Over much of the site, the overburden layer contains a meadowmat unit of variable thickness composed of clayey, silty, organic-rich material. Except for the southern and southwestern portions of the site, the overburden and bedrock layers are separated by the Raritan Fire Clay/saprolite units.

The site hydrogeology consists of three units: (1) an Upper Sand (US) unit, not considered an aquifer, but a zone of saturation which is thin, discontinuous and perched where underlain by the meadowmat; (2) a Lower Sand (LS) unit, which is the primary overburden water-bearing unit and is found unconfined in the northwestern portion of the site and confined, to varying degrees, where it is overlain by the meadowmat; and (3) the bedrock unit which is a semi-confined aquifer underlying the Weathered Bedrock Group (Raritan Fire Clay, Saprolite and weathered bedrock units) at most locations, with groundwater occurrence and movement predominantly in the fractures. Groundwater flow within the LS and bedrock units is southeasterly toward the Raritan River. Both the meadowmat and the Raritan Fire Clay/saprolite are considered to be semi-confining layers due to their low permeability.

The interrelationship between surface water and groundwater is limited to the overburden aquifer and varies between recharge and discharge modes according to locale and site conditions such as tidal cycle and precipitation events. Overall, both surface water and groundwater ultimately discharge to the Raritan River. The tidal influence investigation indicated that groundwater levels in both the overburden and bedrock aquifers are influenced by tidal fluctuations.

Groundwater levels in the overburden aquifer were affected by tidal influence to a greater extent than the bedrock aquifer. However, water level fluctuations due to tidal influence had no significant effect on groundwater flow direction in either the overburden or bedrock aquifers.

The analytical results from two rounds of monitoring well sampling indicate that organic and inorganic contamination exceeding NJDEP Groundwater Quality Standards is present within the overburden aquifer. The analytical groundwater results also indicate that the bedrock aquifer is essentially uncontaminated. Organic contaminants of potential concern include benzene and the chlorinated VOCs TCE, PCE, 1,2-DCA, total 1,2-DCE, chlorobenzene and vinyl chloride. The VOCs are generally found in seven plumes in the overburden aquifer within the north and north central portions of the site. Inorganic contaminants of potential concern include arsenic and aluminum, which are predominantly found in the southern portion of the site. SVOCs, pesticides/PCBs, thiodiglycol, cyanide, dioxin and furans are not considered contaminants of potential concern. Explosive compounds (2,4-dinitrotoluene, 2-6-dinitrotoluene, and amino-DNT's) are considered a potential concern within the groundwater downgradient of Area 4.

The former Arsenal site and adjacent areas have experienced 32 years of extensive construction, development, industrial/commercial activities and other uses since the Raritan Arsenal was closed in 1963; extending the potential sources of contamination substantially beyond historical DOD source areas. In addition, the compounds of potential concern which have been identified as a result of the Phase 2 RI are common contaminants found within many industrialized and developed areas of New Jersey. It is recommended that the following general investigations be carried out prior to any further specific investigation of AOCs offsite at the former Arsenal.

- Surface water and sediment should be sampled within the Raritan River, both upstream and downstream of the former Arsenal site to ascertain background levels of metals and other contaminants, which may be influencing the southern tidal portion of the site.

- Development activities and plans for the Raritan Center Industrial Park and other areas within the former Arsenal should be identified, as construction activities undertaken during and following the completion of the groundwater investigation have resulted in further alteration of site hydrology and have potentially affected contaminant migration and transport.

- An evaluation of DOD and non-DOD contaminant sources at the former Arsenal and the potential for off-site sources to contribute to contaminant levels in groundwater is recommended.

- The Phase 2 RI data indicates that the overburden aquifer does not meet the requirements of a Class IIA aquifer in the southern portion of the site. Collection of two additional rounds of water samples from selected wells in the southern portion of the site for chloride, TDS and other appropriate groundwater quality indicators is recommended.

This information will be used to support an application to the NJDEP to reclassify the southern portion of the site as a Class IIIB aquifer, not subject to potable use. This aquifer designation has previously been applied to locations on the southeastern shore of the Raritan River, opposite the former Arsenal.

- NJDEP regulations include a provision for the State to designate areas of exception to strict application of the GWQS in certain, specific situations. The northern portion of the former Raritan Arsenal may qualify as a Classification Exception Area (CEA) and it is recommended that this option be developed as part of a Remedial Action Work Plan for future groundwater management at the site. This Remedial Action Work Plan will contain specific recommendations for additional monitoring well installation and the periodic sampling of new and existing wells.

- It is recommended that monitoring well MW-31 be grouted and sealed to eliminate the potential for contamination to penetrate the Raritan Fire Clay unit. A detailed evaluation of wells installed prior to the Phase 2 RI is recommended to determine whether additional wells should be grouted.

- An additional shallow groundwater screening investigation within Area 4 is recommended to identify potential explosives contamination at locations closer to suspected contamination source areas than locations monitored by the existing well array.

SECTION 1.0

INTRODUCTION

1.1 PURPOSE OF THE REPORT

Roy F. Weston, Inc. (WESTON®) was awarded an Indefinite Delivery Contract (DACA41-92-D-8002) by the U.S. Army Corps of Engineers (USACE), Kansas City District (KCD), to carry out an additional environmental evaluation of the former Raritan Arsenal (former Arsenal). The work covered under the contract scope of work (SOW) involves the professional services necessary to complete a Remedial Investigation/Feasibility Study (RI/FS), a Remedial Design (RD), and Title II services for areas of concern (AOCs) at the former Arsenal. The USACE is conducting the RI/FS/RD activities at the former Arsenal under the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS). Oversight responsibility for the Phase 2 RI of the former Arsenal was transferred from the KCD to the New England Division (NED) of the USACE during 1994. The United States Environmental Protection Agency (USEPA) and the New Jersey Department of Environmental Protection (NJDEP) provide regulatory oversight and review support for the project.

This Site-Wide Hydrogeology report summarizes the results of a Phase 2 RI performed from June 1993 through March 1995 at the former Arsenal. Specifically, the report

- discusses site history and previous investigations;
- summarizes the results of the Phase 2 RI area-specific soil sampling program and the surface water and sediment investigation; and
- presents the results of site-wide groundwater sampling and the supplemental hydrogeologic investigation.

The report also includes a discussion of the nature and extent of groundwater contamination, potential fate and transport of soil, sediment, surface water and groundwater contaminants and an evaluation of the overburden and bedrock aquifers.

As part of the Phase 2 RI, WESTON planned and implemented a site-wide groundwater investigation, which included a shallow groundwater screening (SGWS) investigation using the Geoprobe method, installation of groundwater monitoring wells, and sampling of groundwater from existing and newly installed monitoring wells. In addition, a supplemental hydrogeological investigation, including a stratigraphical investigation, a groundwater level monitoring program, and a tidal influence investigation, were performed. The Phase 2 RI groundwater investigation was performed to confirm the results of previous investigations, characterize the nature and extent of groundwater contamination, develop a conceptual site-wide geologic and hydrogeologic model, establish background groundwater quality data and evaluate contaminant migration pathways and potential receptors.

1.2 SCOPE OF WORK

The Phase 2 RI at the former Arsenal was conducted during five separate field efforts from June 1993 to March 1995. The Phase 2 RI was performed to characterize the physical properties of the site and define the nature and extent of possible soil, sediment, surface water and groundwater contamination. The activities performed during the Phase 2 RI included the following:

- Area-specific soil investigations including the drilling of soil borings, the collection and analysis of soil samples and installation of groundwater monitoring wells.
- A surface water/sediment investigation, including the collection of surface water and sediment samples from surface water bodies within AOCs.
- A site-wide groundwater investigation, including a shallow groundwater screening investigation (SGWS), a supplemental geologic/hydrogeologic investigation (stratigraphical investigation, groundwater level monitoring, tidal influence investigation and hydraulic conductivity testing) and the collection of groundwater samples for laboratory analysis.
- A physical site characterization investigation, including a surface water survey, wetlands survey, floodplain survey, preliminary wetlands assessment, surrounding well use survey, and a preliminary evaluation of potential sources of contamination unrelated to past army use of the site.

1.3 SITE BACKGROUND

1.3.1 Site Description

The former Arsenal encompasses approximately 3,227 acres and is located in Edison and Woodbridge Townships, Middlesex County, New Jersey. The former Arsenal is bordered to the north and northwest by Woodbridge Avenue, to the southwest by Mill Road and the ILR Landfill, to the south and southeast by the Raritan River, and to the east by vacant and industrial properties. The general location and approximate property boundaries of the former Arsenal are depicted on the Site Location Map (Figure 1-1). A site map showing the physical features of the former Arsenal is presented on Figure 1-2.

The former Arsenal property is currently owned or occupied by the following:

- Middlesex County College (MCC); owned by Middlesex County.
- Thomas A. Edison County Park; owned by Middlesex County.
- United States General Services Administration (GSA).
- United States Environmental Protection Agency (USEPA).
- Raritan Center Industrial Park; owned by Summit Associates Inc. (Summit) and Federal Business Centers (FBC).
- Several privately owned light industrial, warehousing, and hotel operations.

According to the Dames & Moore Archival Search Report (July 1993), MCC occupies approximately 163 acres in the northwesternmost portion of the former Arsenal. This parcel was purchased by Middlesex County from GSA in 1964. A few buildings previously constructed and utilized by the Army remain and are currently utilized by the College for various administrative purposes. However, a majority of the buildings utilized by the College were constructed by Middlesex County in the 1960s and 1970s. In addition, the Thomas A. Edison County Park occupies approximately 150 acres immediately south of the College. The Park includes baseball and soccer fields, tennis courts, a running track, parking lots, maintenance buildings and common open space.

The USEPA's Region II office obtained Buildings 5, 6, 7, 10, 18, 209, and 210 in the early 1970s for use as its field office. In 1988, the USEPA purchased Building 212 and an additional 164-acre parcel from the GSA. The USEPA and its contractors maintain office and general operations space for over 300 personnel. The Region II Laboratory, Emergency Response Team, Research and Development staff, and Removal and Emergency Response staff occupy this area. The GSA also utilizes some of this area for fleet vehicle storage, sales, and distribution, with much of the land remaining vacant and undeveloped.

In 1989, GSA sold a 3-acre plot of land to the Middlesex Interfaith Partners with the Homeless, and another 23-acre plot to TWC Realty. The GSA currently owns two parcels of land: 1) a 19-acre plot in the southwest corner of the site, and 2) an 11-acre plot next to MCC. The area along Woodbridge Avenue immediately northwest of the USEPA-owned property is owned and occupied by Owens-Illinois, Inland Container Corporation, Tastykake, and Ardmore Textured Metals.

During 1964, the GSA sold 2,000 acres of the former Arsenal to the Visceglia family. This family formed the company Federal Storage Warehouses. In 1975, Federal Storage Warehouses divided into two companies (Summit and FBC) and built Raritan Center, a major industrial park complex. Raritan Center comprises the northeastern, central, and southern portions of the former Arsenal. Raritan Center currently hosts over 90 office buildings, storage warehouses, and light manufacturing facilities and is New Jersey's largest office/light industrial center. This area continues to be developed, with future plans considering a park-and-ride center and additional construction/expansion of light industrial and warehouse space within the former Arsenal.

The southern portion of the former Arsenal, adjacent to the Raritan River, has remained relatively inactive since the departure of the Army in the 1960s. This inactivity is attributed to the presence of wetlands and floodplains, making this area undesirable for development. A few manufacturing/blending operations have occurred within the southern portion of the former Arsenal. These include operations such as Huber Inks, the LaPlace Sulfur Plant and a small concrete plant. The Middlesex County Utilities Authority operates a sewage treatment plant pumping station within the southern portion of the site. Several former magazines have been used for industrial operations, including a pallet factory, blending of pesticides and herbicides and a helicopter spraying storage area for the Middlesex County Mosquito Commission (MCMC). The majority of the remaining former magazines remain vacant. A small portion of Area 12 has been utilized as a demolition range by EOD Technology, Inc. (EODT) and UXB as part of the unexploded ordnance (UXO) investigation at the former Arsenal.

The former Arsenal is serviced by a Municipal Sanitary Sewer System and potable water is supplied by Middlesex Water Company. Groundwater beneath the boundaries of the former Arsenal is not being used for industrial, municipal, domestic or irrigation purposes. In general, stormwater runoff flows to storm sewers in the developed positions of the former Arsenal and discharges to surface water bodies in the undeveloped southern portions of the site. All site drainage discharges to the Raritan River.

1.3.2 Site History

Prior to the U.S. Army construction of the former Arsenal in 1917, the property consisted of tidal marsh, clay and sand pit quarries, and farmland with several residences. The site was developed by the Army to ease congestion of Atlantic seaboard ports and to facilitate military shipments to Europe during World War I. It was originally designed to be a temporary depot for the storage, staging, and shipment of munitions. However, by 1922, the former Arsenal was considered a permanent military establishment. Originally comprised of 2,137 acres, it eventually expanded to 3,227 acres (OBG, 1989).

The former Arsenal was used extensively by the Army from 1917 to 1963. During this time, the marsh areas immediately adjacent to the Raritan River were filled with sediments dredged from the Raritan River and Raritan Bay. Roads and railways were built on embankments created from fill material, to elevate them above tides and frequent floods. The prospectus issued by the Army in 1961 indicates that there were 446 permanent and semipermanent buildings, 80 miles of railroad track, three rail spurs, 108.5 acres of primary and secondary roads, 81.3 acres of parking, over 2.1 million square feet of storage in magazines and warehouse buildings, 2.1 acres of sidewalks, five miles of pipe, 22,000 square feet of sewage disposal area, 190,000 linear feet of sewage collection lines, 1.35 million gallons of water storage capacity in two large tanks, 88,000 linear feet of water lines to provide for a daily consumption of 400,000 gallons, and associated infrastructure to provide for 15,000 people (OBG, 1989).

Operations at the site included the receipt, storage, shipment, and/or decommissioning of ordnance, arms, and machinery and their subsequent shipment to Europe. Storage was typically in warehouses and magazine buildings and, in some instances, outdoors. Material was shipped by rail, roadway, and from the dock area on the Raritan River. The decommissioning activities included equipment and ordnance dismantling for subsequent disposal.

During this period, some waste materials, including ordnance and chemical agents (mustard, red nitric acid, and miscellaneous chemicals), were reportedly buried on site. It also has been reported that explosive materials routinely were destroyed by surface burning or burning in chambers or pits. Accidental explosions in magazine buildings and outdoor storage areas reportedly scattered explosive materials over large areas, and drove ordnance fragments into the ground (Metcalf and Eddy, 1991).

Operations at the former Arsenal were phased out between 1961 and 1963. Decontamination of the site was initially performed under the direction of former Arsenal personnel in 1963, and later under the direction of personnel from the Letterkenny Army Depot (LEAD) and the Army Material Command Safety Office. LEAD designated 17 areas as potentially contaminated in a study during 1963 (LEAD, 1963). Subsequently, the Army recommended that each area be designated for "Unrestricted Use," "Surface-Use Only," or "Non-Use" as deemed appropriate. Areas designated "Surface-Use Only" and "Non-Use" included pits possibly holding potassium cyanide and mustard gas containers within Area 5, and areas that potentially contained live ordnance.

Fourteen of the 17 sites designated as potentially contaminated are currently located within the Raritan Center and are owned by either Summit or FBC (Metcalf and Eddy, 1991). The GSA also sold a parcel of land, located on the western part of the site, to Middlesex County. The county developed the area into Thomas A. Edison County Park and MCC. Thomas A. Edison County Park, USEPA offices, and Raritan Center occupy the majority of the former Arsenal.

The southern half of the site has remained primarily marshland, with limited development since the former Arsenal closed in 1963. The ILR Landfill, operated in the 1970s and closed by a court order in 1985, is located immediately adjacent to the southwest border of the former Arsenal (OBG, 1989).

Specific details relating to site history are presented in Dames & Moore's Archive Search Report. The Dames & Moore Archive Report also mentions other historical uses of the former Arsenal and surrounding land which are not related to former DOD activities at the site.

1.3.3 Previous Investigations

In November 1987, OBG was retained by the USACE - KCD to perform a contamination evaluation of the former Arsenal. During the OBG investigation, the 17 AOCs identified by

LEAD were evaluated and prioritized during development of the work plan. Due to the limitation of resources, field investigations were not conducted within several of the AOCs with low priorities (Areas 8, 10, 12, 13, 14, 16, and 17).

A total of 30 monitoring wells were installed by OBG at the former Arsenal, consisting of 27 shallow wells averaging 20 feet in depth, and 3 deep wells ranging from 30 to 58 feet in depth. Groundwater samples collected from all 30 wells were analyzed for VOCs, TPHC, explosives, and general indicator parameters. In addition, in situ permeability tests were conducted at seven monitoring wells (MW-5, MW-7, MW-13, MW-16, MW-26, MW-28, and MW-34) to provide a general understanding of the aquifer characteristics.

A total of 28 soil borings were performed to a minimum of 15 feet below grade during the OBG soil investigation. Three samples were obtained from each soil boring at 0 to 5 feet, 5 to 10 feet, and 10 to 15 feet. A total of 84 soil samples were submitted for VOCs, metals, and explosives analysis. A total of 40 shallow soil samples were also obtained throughout the former Arsenal from a depth of 0 to 2 feet below grade. The shallow soil samples were analyzed for VOCs, priority pollutant metals, general indicator parameters, and explosive compounds.

A total of six surface water locations were sampled in the streams and wetlands of the site to evaluate potential effects on surface water from the AOCs. Surface water samples were analyzed for VOCs, metals, TPHC, explosives, and general indicator parameters.

OBG presented a preliminary determination on the possible presence of chemical contamination and/or ordnance associated with former DOD activities at the former Arsenal in their report entitled *Final Engineering Report, Former Raritan Arsenal, Contamination Evaluation*, Revised November 1989. The report was distributed on 20 February 1990.

The next investigation of the former Arsenal was performed by Metcalf and Eddy under contract with the USACE - Huntsville Division. Metcalf and Eddy prepared an *Archive Search Report* dated 7 October 1991 for MCC and Thomas A. Edison County Park. The report provides historical and background site information and summarizes the findings of the archive search and interviews as they pertain to known and suspected areas of ordnance and explosive waste (OEW) contamination on the land that is presently owned by Middlesex County.

International Technology Corporation (IT) was retained by the USACE - Huntsville Division to perform OEW location and removal at the former Arsenal. IT subcontracted to EODT to provide ordnance expertise. The objective of the project was to perform OEW location and removal at 17 areas identified as suspected contaminated sites by the 1963 LEAD report, the OBG 1989 report, and the Metcalf and Eddy, Inc. 1991 report. The final report submitted by IT was entitled *Former Raritan Arsenal Removal Action*, June 1992.

As a result of IT's activities, OEW were located and removed at the following locations: Area 1, Area 4 (within IT's Scope of Work [i.e., TNT to 1/2 inch]), Area 16 (Buildings 643 and 644), Area 17, and Building 118. Area 10 also had work in progress when IT demobilized due to lack of funds. In addition, minimum preparation work was performed, but no field operations were conducted at the following locations: Areas 2, 3, 6, 7, 8, 9, 11, 12, 13, 14, and the spoils area at Middlesex County Utilities Authority.

Dames & Moore subsequently performed a Phase 1 soils and groundwater RI. A report entitled *Preliminary Report, Phase 1 Remedial Investigation of Selected Areas of Former Raritan Arsenal*, dated 2 October 1992 presented the results of the investigation. The intent of the investigation was to begin the assessment of the presence and extent of soil and groundwater contamination attributable to operations and activities formerly conducted at the former Arsenal. Field activities during this investigation included the following: performance of soil gas surveys; UXO screening at sample locations and along access routes; the advancement of 183 soil borings and collection of soil samples for laboratory analyses; the installation of 21 shallow and 6 deep monitoring wells; the sampling of 27 newly installed and 25 existing monitoring wells; collection of sediment and surface water samples for laboratory analyses; the collection of a surface soil sample in Area 11 for laboratory analyses; and the collection of data on site hydrogeologic conditions. The *Final Report, Phase 1 Remedial Investigation of Selected Areas of Former Raritan Arsenal* was released in April 1993.

In addition to the above investigation, Dames & Moore prepared a report entitled *Near-Surface Soil Sampling Program, Thomas A. Edison County Park and Middlesex County College, Former Raritan Arsenal*, dated 2 October 1992. The report presented the results of the soil sampling program performed at the MCC ballfield area and in the developed portions of Thomas A. Edison County Park. The analysis of soil samples collected during the Phase 1 RI by Dames & Moore detected the presence of heavy metals that exceeded the NJDEP soil cleanup criteria at the park and college ballfield. This resulted in a decision by administrators of both facilities to close the areas for public use. The intent of the investigation presented in the report was to provide additional information concerning the presence of metal contamination in near-surface soils. The sampling analysis program was conducted at the request of the MCC and Thomas A. Edison County Park personnel.

During the investigation, 40 near-surface soil samples were collected from areas frequented by park personnel and the general public in the park area. Additionally, eight subsurface soil samples were collected in the vicinity of underground utility lines. Ten near-surface soil samples were collected in and adjacent to the college ballfield, and two subsurface soil samples were also collected in the vicinity of underground utility lines.

Because of the elevated concentrations of contaminants found during the two previous investigations, Dames & Moore prepared a Work Plan for the USACE, dated 8 October 1992, to conduct a Limited Health Risk Assessment (LHRA) for MCC and Thomas A. Edison County

Park. The purpose of the investigation, which was completed in June 1993, was to gather additional surface soil sample data and to evaluate the risk of exposure to potentially contaminated surface and subsurface soil in Thomas A. Edison County Park, and Area 17A (the MCC baseball field and surrounding area).

Dames & Moore established a 200-foot grid over the general use areas of Thomas A. Edison County Park and 100-foot grids over high-activity areas, which had a higher potential for soil disturbance. A 100-foot grid was also established at the former Wastewater Treatment Plant (WWTP) area within the park because of the higher potential for contamination. Forty-two additional locations were sampled around five magazine foundations and magazine 447. In order to assess the worker exposure risk along underground utilities, soil samples were collected every 200 feet along existing utility lines.

Dames & Moore also established a 100-foot grid over the Area 17A baseball field and immediate surrounding area, and a 50-foot grid over the portion of the infield identified as the former burning ground. An additional sampling program was undertaken to assess worker exposure associated with working on active utility lines in the park which are greater than 2 feet deep. Soil samples were collected every 200 feet along these existing utility lines.

In order to complete an evaluation of potential exposure to contaminants, background sampling results from a remote location was also carried out under the LHRA. Thirty-six surficial samples were collected from Raritan Park. The park is an 8-acre multi-use facility with a playground, a picnic area, and a baseball field located across Woodbridge Avenue from the former Arsenal. The analytical sample results gave a baseline background soil concentration for compounds of concern at the former Arsenal.

The results of the LHRA were released in June 1993. Based upon the results of sampling, compounds of concern which were evaluated for risk were arsenic, lead, carcinogenic polynuclear aromatic hydrocarbons (CaPAH) and dioxins/furans. Although levels of arsenic, lead and some CaPAHs exceeded NJDEP soil cleanup criteria, the LHRA determined that the calculated risks for each individual exposure scenario were within the range of acceptable risks of $1x10^{-4}$ to $1x10^{-6}$.

The USACE authorized Dames & Moore to conduct a Historical Archival Search for the entire former Arsenal. A preliminary report of the archival search for the entire former Arsenal was released in May 1993, with the final report released in July 1993.

Personnel from EODT conducted a subsurface investigation in Area 5, including a geophysical survey, the drilling of 70 soil borings, the installation of 3 monitoring wells and the collection of soil and groundwater samples for chemical warfare (CW) agent screening analysis. Compounds of concern were not found in any of the samples (soil or groundwater) collected in Area 5. In conjunction with EODT's subsurface investigation, WESTON performed a

Preliminary Site Investigation (SI) as part of the expedited Phase 2 RI activities. The SI consisted of WESTON receiving a total of 32 split soil samples (certified to be free of CW agent contamination) from 14 of EODT's 70 soil borings. The samples were analyzed for hazardous and toxic waste (HTW) parameters.

EODT completed two reports entitled *Final Report for the Geophysical Mapping and Sampling of Areas 2, 3, 4, 6, 8, 9, 10, 11, 13, 14, 15, 16, 16A, 18B, 18C, 18D, 19 and MCC at the Former Raritan Arsenal, Edison, New Jersey* and *Final Report for the Removal Action of Areas 2, 18D and Spoils Area at the Former Raritan Arsenal, Edison, New Jersey*. These two reports discuss the mapping and removal of UXO/Ordnance and Explosive Waste (OEW) at the former Arsenal.

1.3.3.1 Background Quality Investigations

Background sampling is required to distinguish site-related contamination from naturally occurring or other non-site-related levels of chemicals. Background levels of chemicals relevant to the former Arsenal consist of naturally occurring levels that have not been influenced by anthropogenic sources. These sources include man-made activities such as local industry or automobiles.

As part of Dames & Moore's Limited Health Risk Assessment (LHRA), 36 surficial soil samples were collected from nearby Raritan Park in order to generate background soil data in the vicinity of the former Arsenal. The analytical results obtained from these soil samples were used to provide a baseline background soil concentration for compounds of concern at the site. Raritan Park is located directly north of the former Arsenal. The USEPA and NJDEP agreed that data obtained from the LHRA soil sampling at Raritan Park could be used to evaluate background conditions for soils at the former Arsenal. Raritan Park is an 8-acre, multi-use facility with a playground, a picnic area and a ballfield. The park is located across Woodbridge Avenue from the former Arsenal. The park is located behind a senior citizens center and next to the New York Times building.

Background soil samples were obtained from 36 locations in Raritan Park. Seventy-five percent of the samples were collected from 0- to 1-foot, and 1- to 2-foot depth intervals. The remaining 25 percent of the samples were collected from a 2- to 4-foot depth interval. Approximately 50 percent of the samples were analyzed for USEPA Resource Conservation and Recovery Act (RCRA) metals. Twenty-five percent of the samples were analyzed for USEPA Target Analyte List (TAL) metals. Twenty-five percent of the samples were analyzed for USEPA Priority Pollutant Metals. In addition, soil samples from four locations were obtained from 0- to 1-foot, 1- to 2-foot and 2- to 4-foot depth intervals and analyzed for USEPA Target Compound List (TCL) parameters, explosives, and dioxin (total 12 samples).

The analytical results of the Raritan Park background soil samples indicate that, in general, the concentrations of metals detected fell within the range of typical element concentrations in natural soils (*Hazardous Waste Land Treatment*, USEPA 1983). VOCs and polychlorinated biphenyls (PCBs) were not detected in the soil samples from Raritan Park. Low concentrations of pesticides (4,4'-DDD, 4,4'-DDE, 4,4'-DDT, endrin, and methoxychlor) were detected in 12 soil samples. Low concentrations of dioxins and furans were detected in samples collected from four locations. One of the four sample locations analyzed for TCL parameters contained SVOCs.

Sampling of media other than soil was not included in the Dames & Moore program; therefore, background quality data for groundwater, sediment, and surface water compounds of concern were not established during previous investigations.

WESTON's Phase 2 RI Work Plan proposed background quality sampling of sediment, surface water, and groundwater. However, due to problems identifying potential locations suitable for establishing background conditions for surface water and sediment, background quality sampling was not performed during the Phase 2 RI. Recommendations for performing background sampling at surface water and sediment locations are presented in WESTON's Phase 2 RI Sitewide-Surface Water and Sediment ROI. During the Phase 2 RI groundwater investigation, WESTON installed and sampled eight background quality monitoring wells (four overburden and four bedrock). The results of groundwater background sampling are presented in Section 6 of this ROI.

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SECTION 2.0

REGIONAL HYDROGEOLOGY

As part of the Phase 2 RI, WESTON evaluated regional reference data regarding soils, geology, hydrology and climate. A summary of that review is provided below.

2.1 REGIONAL SOILS

The soils present within the former Arsenal study area reflect extensive human activity in the northern sections. Cut and fill activities, clay pits, and fluvial alterations within the study area have led to inconsistent subsurface profiles. Soils identified within the study area are mapped into three general groups by the United States Department of Agriculture, Soil Conservation Service (USDA, SCS).

1. Urban land-Boonton-Haledon: Urban land and nearly level to strongly sloping, deep, well drained to somewhat poorly drained soils that have a firm or very firm, loamy subsoil; on uplands.

2. Klej-Atsion-Evesboro: Nearly level to strongly sloping, deep, excessively well drained and moderately well drained to poorly drained soils with a sandy subsoil and substratum; on terraces and uplands.

3. Sulfaquents-Sulfihemists-Psamments: Nearly level, deep, excessively drained to very poorly drained mineral and organic soils with a grayish or black subsoil; on tidal flats.

Surface material typically grades gently from tidal marsh material near the Raritan River to sands and sandy loams between 1 to 2 miles inland.

The specific soils mapped by the USDA, SCS (1988) are described below. The various soil types identified within the study area are delineated on the soils delineation map (Figure 2-1).

SU - Sulfaquents and Sulfihemists, frequently flooded. One third of the study area is covered with these soils. Level, very poorly drained organic soils, in tidal marsh areas, and subject to tidal flooding. Vegetation tends to be saltmeadow cordgrass and smooth cordgrass. Included with these soils when mapped are small areas of Atsion, Mullica and Fallsington soils. Permeability is moderate, and water capacity is high. The water table is near to the surface, and fluctuates very little.

Mu - Mullica sandy loam. A level, poorly drained soil in low-lying upland flats and slight depressions. Usually the surface is covered with a 4-inch thick layer of black muck. Small areas are prone to flooding. Permeability is moderate to rapid.

PL - Dominantly spoil that remains in a borrow clay pit after mining has taken place. Some of the pits have been smoothed, while others contain mounds. This unit's characteristics are variable: there are a wide range of textures in this soil, and the water table is within several feet of the surface.

PW - Psamments, waste substratum. Excessively drained to well drained soils that have been used to cover landfills, with smooth surfaces that are nearly level to gently sloping.

PM - Pits, sand and gravel. This unit is predominantly spoils material from borrow or sand or gravel pits after mining has taken place.

PN - Psamments, nearly level. Deep, well drained soils in dominantly regraded sand pits or borrow areas that have been smoothed. Up to 50 percent pebbles.

PO - Psamments, sulfidic substratum. Deep to shallow, moderately well drained and somewhat poorly drained soils that consist mostly of dredge material with a wide range of texture and thickness.

At - Atsion Sand. A nearly level and poorly drained soil along drainage ways, basins and low-lying flats. Moderately rapid to rapid permeability, with low available water capacity.

LaA - Lakehurst Sand, 0- to 3-percent slopes. A nearly level and moderate to well drained or somewhat poorly drained soil. Rapid permeability and a low water capacity with a very low fertility make this soil poorly suited for crop cultivation.

Ma - Manahawkin Muck. A nearly level and poorly drained soil on floodplains. Moderately slow to moderately rapid permeability, with high available water capacity. Use limited by flooding.

KlA - Klej loamy sand, 0- to 3-percent slopes. A nearly level, moderately well drained to somewhat poorly drained soil with slow permeability (variable where disturbed), with low to high water capacity, depending on cuts, fills, etc.

NaB - Nixon Loam, 2- to 5-percent slopes. A gently sloping and well drained soil, with moderate to moderately rapid permeability. Available water capacity is moderate.

KfA - Keyport Loam, 0- to 2-percent slopes. Nearly level and moderately well drained, with slow permeability and high available water capacity.

KfB - Keyport Loam, 2- to 5-percent slopes.

SlB - Sassafras Loam, 2- to 5- percent slopes. Permeabilities of the subsoil are moderate and in the substratum are moderately rapid.

UC - Moderately deep to deep, well drained to somewhat poorly drained soils. Formed in stratified or graded sandy or loamy fill material with up to 35 percent gravel. These soils have been disturbed in some way, primarily by filling or cutting. Variable characteristics, with acidity being strong to extreme.

WdA - Woodstown sandy loam, 0- to 2-percent slopes. A gently sloping, well drained soil on side slopes of depressions and slight knolls. These soils have moderate permeability, with high available water capacity.

NCB - Nixon-Urban land complex, 0- to 5-percent slopes. Areas consisting of nearly level to gently sloping, well drained Nixon Soils and developed areas. Forty percent (40 percent) of the areas are covered with Nixon soils, and 40 percent are covered with impervious surfaces. The remaining 20 percent are small areas of Sassafras loam and soils with a surface area of silt loam.

BUB - Boonton-Urban land complex, 0- to 5-percent slopes. Nearly level to gently sloping, well drained to moderately well drained soils and areas that are used for urban development. Forty percent (40 percent) of the areas mapped as BUB are soils, and 40 percent are covered by impervious surfaces such as buildings, parking lots, etc. The other 20 percent are small areas covered by Haledon and other silt loams.

UL - Urban Land. Areas where more than 80 percent of the cover is impervious, such as industrial plant(s), shopping and business centers, and parking lots.

The Manahawkin Muck, Mullica, Sulfaquents, Sulfihemists, Atsion, and Klej soil types have been identified as hydric soils by the United States Department of the Interior, Fish and Wildlife Service, National Wetlands Inventory, Wetlands of New Jersey (July 1985).

2.2 REGIONAL GEOLOGY

2.2.1 Regional Geology Overview

Middlesex County is located within two major physiographic provinces: the Coastal Plain and the Piedmont. The differences in the two provinces are based largely upon the prevailing rock type, bedrock structure, climate, and the geomorphic history. The elevation is about 60 to 100 feet above sea level in the Woodbridge-Piscataway area and 200 to 400 feet above sea level in South Brunswick Township. An area covering the northwestern third of the county is in the Piedmont physiographic province and is underlain, for the most part, by soft red shale of the Newark group of Triassic age. The Piedmont part of the county is typically a nearly flat plain dotted with rounded hills.

The former Arsenal is situated within the Coastal Plain Physiographic Province. The region in the vicinity of the Arsenal is characterized by Triassic and Jurassic Rocks of the Newark Group overlain by unconsolidated sediments (cyclic beds of clays, sands and gravels) that are Cretaceous in age. The boundary between the Cretaceous and Newark Group Triassic Rocks represents an unconformity resulting from extensive erosion during the cyclic rises and falls of sea level between 140 and 200 million years ago (mya). The Triassic Newark Group bedrock is unconformably underlain by Pre-Cambrian rocks. A geologic map identifying formations outcropping within the State of New Jersey is provided on Figure 2-2. A geologic cross section of Middlesex County is presented on Figure 2-3. The cross section runs from northwest to southeast (Stelton through Runyon to the county line) and crosses the Raritan River to the south of the former Arsenal. It should be noted that this cross section does not depict all of the overburden units known to be present at or adjacent to the former Arsenal.

The Triassic rocks of the region are characterized by sedimentary sequences that were deposited in the Newark Basin, one of the long narrow basins that extended from Nova Scotia to North Carolina (Banino et al., 1970). These basins formed as a result of the rifting of the continental plates at the time of the formation of the Atlantic Ocean basin. Zones of rifting permitted the extrusion of the Watchung basalt lava flows and the intrusion of diabase sills and dikes in the Edison, Woodbridge, Rocky Hill and Palisades areas. Uplifting that resulted from later collision of the continental plates created the parallel ridges separating the Newark basin from the Atlantic Ocean basin. Mountains, such as the Appalachian Mountains, that surrounded this basin supplied the sediments that now comprise the Triassic Formations. As a result of this sediment deposition, Triassic-aged siltstone, shale, sandstone and conglomerate bedrock were formed.

Triassic Formations of the Newark Group include (from oldest to youngest); a) arkosic sandstone, red siltstone and sandstone, conglomerate with some red shale of the Stockton Formation; b) cycles of gray and black argillite and siltstone of the Lockatong Formation; and c) red-brown mudstone, siltstone, sandstone and conglomerate of the Passaic Formation. The Passaic Formation described above was once included in a larger formation known as the

Brunswick Formation (now divided into seven formations), which included rocks formed during the Triassic and Jurassic time periods.

The Newark Basin is bounded on the northwest by the Ramapo fault. This fault is a normal fault which separates the Pre-Cambrian rocks of the New Jersey Highlands from the Triassic-Jurassic rocks of the Piedmont lowlands. During the period of deposition and active tectonics, down-dropping of the basin continued along the fault. As a result, the rocks in the basin generally dip 5 to 25 degrees to the northwest. The oldest exposed formations are seen along the eastern edge of the basin, and the youngest rocks are seen along the western edge at the fault. Following the formation of the Triassic-aged sedimentary rocks, igneous intrusions consisting locally of diabase (traprock) occurred. Extrusive basalt flow formations and sedimentary deposits of the Jurassic age (formerly part of the Brunswick Formation) occur locally within the Newark Basin (Olson, 1980).

The Coastal Plain physiographic province is underlain by unconsolidated sands and clays of Cretaceous age. The Coastal Plain is mainly a nearly level surface with slight undulations. The elevation is mainly between 100 and 140 feet above sea level. Seven geologic formations comprise the Coastal Plain in Middlesex County which include the Raritan Formation (and its seven members) and consist mostly of alternating layers of dark glauconite, clay, fine sands, and coarse glauconitic sands. Where exposed, soils formed on these formations reflect the character of the underlying parent material.

A geologic map showing Triassic bedrock and Cretaceous overburden exposures within Middlesex County is presented on Figure 2-4.

In the Quaternary period, which dates from the beginning of the Ice Age (2 mya), there were four major great ice sheets moving from centers in Canada into the northern part of the United States, interspaced with times of partial submergence and deposition. In Middlesex County, there is evidence of only the last ice sheet. This consists of Wisconsin drift which blankets the northern one-third of the county. The oldest non-glacial Quaternary deposits have been entirely removed from the county. The Pensauken Formation, which is much older than the Wisconsin drift, is capping the hills and higher divides but has been removed from the larger stream valleys. The Cape May Formation, which is probably slightly older than the Wisconsin drift, is found mainly in stream valleys. Since the Wisconsin ice sheet, there have been only relatively slight physiographic changes in the county. Based on existing information, glacial ice advance never reached the approximate site location (Barnsdale, 1943)

A general geologic map of Quaternary period overburden units within Middlesex County is presented on Figure 2-5.

A detailed description of individual formations comprising the Coastal Plain Physiographic Province present in the vicinity of the former Arsenal is provided in the following sections.

2.2.2 Bedrock Lithologies

2.2.2.1 Sedimentary Formations

In the vicinity of the site, the only Triassic Age Newark Group (Figure 2-4) sedimentary rock identified is the Passaic Formation. The Passaic Formation is comprised of a variable dark reddish-brown to gray-lavender shale (sandstone-siltstone) and mudstone deposited in cyclic sequences with 0.5- to 1.5-millimeter (mm) epidote-chlorite nodules. Cycles in the Passaic Formation range from lacustrine sequences identical to those of the Lockatong Formation to entirely red mud flat cycles that culminate in cross-laminated siltstone (Olsen, 1980). The formation contains a higher content of sands and pebbles in the vicinity of the study area (Banino et al., 1970). The sand beds can range from 1 to 20 feet, increasing in thickness towards the northeastern part of New Jersey. This formation is believed to be fluvial in origin. Banino et al., (1970) indicate the Passaic Formation to be a fair to good aquifer, extending up to 8,000 feet in thickness in places.

In Middlesex County, the sedimentary rocks of the Newark group generally strike northeast-southwest and dip to the northwest at angles of 5 to 25 degrees. The formations are rather impermeable except along the numerous cracks which everywhere traverse the beds at high angles to the bedding (Barnsdale, 1943). Shales of the Passaic Formation typically have low effective primary porosity, but well developed secondary porosity. The rock is well fractured and weathers easily, allowing for large fractures in the zone of weathering. Fractures may extend several hundred feet in depth (Banino et al., 1970). Well yields can be expected to be good where the shale is overlain by sand and gravel, which retain runoff well.

Groundwater from the Passaic Formation is cited by Banino et al., (1970) to be high in sulfate. The high sulfate content has been associated with the leaching of sulfate minerals associated with local diabases and basalts. An additional source of high sulfate content is the local presence of sulfate minerals such as glauberite, barite, and gypsum. These minerals occur in the red shales of the Passaic Formation.

2.2.2.2 Igneous Formations

Sediments accumulated within the Newark basin on an unconformity of Paleozoic and Pre-Cambrian basement rock. Basic igneous rocks were intruded into the sediments (Palisades Sill, diabase dikes) and extruded onto the sediments (Watchung basalt flows) during the period of deposition. Volcanic activity began during earliest Jurassic time when a fissure eruption extruded a 300- to 600-foot-thick basaltic flow in a 30-mile-long area of the recently deposited Brunswick Group. This lava flow, as it cooled and hardened, created the Orange Mountain Formation which later formed the ridge of the First Watchung Mountain, the southernmost of the three Watchung basalt flows. This flow was covered with approximately 500 feet of silts, sands, muds, and carbonates to form the Feltville Formation. Subsequently, the second series of basaltic eruptions occurred forming the Second Watchung Mountain. Approximately 1,500 feet of sediment was deposited atop this flow before the third and last series of lava eruptions occurred in the Early Jurassic Period, forming the Third Watchung Mountain. Throughout the Jurassic period, the Newark Basin continued to subside, with the greatest subsidence occurring along the northwest border of the basin adjacent to the New Jersey Highlands.

Molten rock was intruded into the Newark group in late Triassic time, and in this region it solidified beneath the surface of the ground in the form of steeply dipping dikes and relatively flat sills. The largest of these is a diabase sill which is now exposed to the north of Palisades, to the east on Staten Island, and to the west in Rocky Hill, New Jersey. The diabase sill stood as a ridge on the pre-Cretaceous surface and was continuous from Rocky Hill to Bayonne. Between Staten Island and Rocky Hill the surface was downfaulted prior to the deposition of the Cretaceous sediments (Barnsdale, 1943).

The intrusion (according to Barnsdale, 1943) of diabase profoundly affected the adjacent beds of shale, those nearest the intrusion being altered to a tough, dark, spotted rock as hard as slate but lacking its cleavability. With increasing distance from the diabase sill, the alteration of the surrounding rock is less and less pronounced, with the rock becoming progressively softer and changing in color from dark gray, brown and greenish gray to light gray, purplish-red, and finally the typical brick red of the unaltered shale. North of Middlesex County where the sill and adjacent beds are exposed, the latter are altered for a thickness of 500 feet or more away from the sill contacts (Barnsdale, 1943). The location of the diabase sill (Palisades Sill) within Middlesex County is depicted on Figure 2-4. The Palisades Sill is comprised of iron-rich diabase, otherwise referred to as traprock.

Diabase is a dense, crystalline, mafic rock, that is free of vugs, and consequently, has no primary porosity. In some regions, diabase intrusions can form hydrologic barriers, causing irregularities in groundwater flow regimes. The host rock at the top and basal contacts of the diabase has been baked by the extreme heat of the molten rock at the time of intrusion. The baked rock has lost most of its porosity and had its fractures healed (Banino et al., 1970), which enhances the effect of the diabase as a barrier to groundwater flow.

2.2.3 Overburden Lithologies

The following description of the unconsolidated units within the Inner Coastal Plain Province has been synthesized from Anderson (1968), Appel (1962), Banino et al. (1970), Barksdale et al. (1943), and OBG (1989). The unconsolidated overburden sediments within the vicinity of the study area have been mapped as two individual units which are the Cretaceous Unconsolidated Sediment (Raritan Formation) and the Quaternary (Pleistocene Cape May Formation). In addition, recent deposits of alluvium and fill sporadically cover the regional area. Descriptions of these units based on existing literature are provided below.

2.2.3.1 Raritan Formation

The Raritan Formation is widely exposed along the Inner Coastal Plain Lowland (Figure 2-4). Members of the unconsolidated Raritan Formation include the Raritan Fire Clay, the Farrington Sand, the Woodbridge Clay, the Sayreville Sand, the South Amboy Clay, and the Old Bridge Sand. Overall, the Raritan Formation ranges from light and dark interstratified quartz sands to variegated clays, silty clays, and clayey silts (OBG, 1989). Lignite (coal) and fossils of terrestrial flora and brackish-water bivalve mollusca, indicate intermittent fluvial and marine or river delta depositional environments. The major members within the vicinity of the former Arsenal are:

- The Raritan Fire Clay, which is a white, light blue, or spotted red clay that grades downward into a reddish-brown color toward the underlying bedrock. It ranges from 2 to 35 feet in thickness and is found mostly in depressions in the bedrock, where it grades almost imperceptibly into the underlying bedrock formation. Typically, the basal part of the clay has a brick-red color identical in shade with the underlying Triassic red shale from which it was derived. Exposed portions (7 feet thick) of the Raritan Fire Clay are described as a gray, "fat" clay of good quality. The top of the clay is undulatory and is overlain by the Farrington Sand Member of the Raritan Formation.

- The Farrington Sand Member is generally a medium- to fine-grained sand and is a coarse, arkosic, light gray or light yellow sand usually containing a considerable sprinkling of small pebbles. The arkosic material, as seen in outcrops, is always partly kaolinized, the white kernels of the partly decomposed feldspar standing out sharply in contrast with the gray and yellow colors of the sand and gravel. The latter is composed chiefly of well rounded quartz pebbles, but also contains numerous pebbles of flint ranging in diameter from a quarter of an inch to a maximum of 2 inches. Occasionally, the gravelly beds contain rather numerous small chunks of red or white clay, quite obviously derived from the underlying Raritan Fire Clay and evidently redeposited close to their source. Lenses of clay, usually only a few feet thick, also occur within the limits of the Farrington Sand, and thin clay seams are fairly common.

2.2.3.2 Cape May Formation

The Cape May Formation is typically a pinkish-yellow, fine- to medium-grained quartz sand with occasional small pebbles of quartz and ironstone, but it sometimes departs considerably from this description. The pebbles are chiefly quartz, but ironstone and unaltered flint were also noted. North of the Raritan River, however, there is a marked change in the composition of the Cape May. There it contains numerous, partly rounded pebbles and fragments of Triassic red sandstone and shale, as well as fairly numerous lumps of Cretaceous clay.

2.2.4 Structural Geologic Features

Other than the diabase intrusion transecting the southeastern portion of the study area, no other major structural features have been identified. Two faults have been identified in the general vicinity. These include the Cornwall-Kelvin Fault, which is of the Atlantic Basin and trends along the axis of the Raritan Embayment (which lies in the mid-Newark Basin) and an unnamed fault which trends westward through Cape May. It is important to note that these faults are not present within the vicinity of the former Arsenal.

The Triassic Formations within the region are highly fractured along the bedding planes, with the principle orientation of the fractures being northwest-southeast. Fractures adjacent to intrusive igneous bodies have most likely been healed (Banino et al., 1970).

2.3 REGIONAL HYDROGEOLOGY

2.3.1 Regional Hydrology Overview

Within the New Jersey Coastal Plain Province, the sediments of the Cretaceous Potomac Group, Raritan, and Magothy Formations are generally considered one hydrologic unit, or an aquifer system (Zapecza, 1984). Over large areas of the Coastal Plain, the units are lithologically indistinguishable from one another. Numerous others have noted the formations to be hydraulically continuous. The two major aquifers that have been recognized in Middlesex County are the Old Bridge Sand Member of the Magothy Formation and the Farrington Sand Member of the Raritan Formation.

2.3.1.1 Overburden Aquifer

The primary aquifer within the vicinity of the former Arsenal area is the Farrington Sand of the Raritan Formation. In this unit, groundwater generally flows in a southerly and southeasterly direction toward the Raritan River. The porosity of the Farrington Sand given by Appel (1962) is 34 percent, with hydraulic conductivity estimated to be between 1200 to 1500 gal/day/ft^2. Unconsolidated sediments overlying the meadowmat (formerly called peat) in the southern portion of the study area may comprise an unconfined perched aquifer of limited areal extent that appears to be tidally influenced.

Water from the Farrington Sand, when uncontaminated, appears to be suitable for most purposes (Barksdale et al., 1943). Total solids tend to be less than 40 parts per million (ppm) and hardness less than 15 ppm. Often iron can be high locally at 2 to 6 ppm. Chlorides in 1943 were cited at 2 to 4 ppm, and in 1964 at 5 ppm, where uncontaminated. The ability of the Farrington Sand to transmit water is relatively high (Barksdale et al., 1943) to the extent that it would not be a limiting factor in well yields. The coefficient of permeability is estimated at 1,350 gal/day/ft^2, and the average thickness of the sand is 80 feet (Barksdale et al, 1943). The hydraulic gradient in 1936 was estimated at 23.4 feet/mile (0.004 feet/feet), though this value has surely changed since then, considering the increased development of the area for industrial use, as well as the problem of salt water intrusion into the aquifer. Salt water intrusion is addressed in Section 2.3.2.

The estimated natural recharge for the Farrington Sand south of the Raritan River was estimated to be 9.7 million gallons per day (mgd) (Hasen et al., 1969). In 1969, the limiting factor governing the full use of the Farrington Sand was cited to be salt water encroachment of the aquifer (Hasen et al, 1969). The rate of encroachment was noted to be decreasing at that point in time, though it is still occurring.

2.3.1.2 Bedrock Aquifer

Regional hydrological information indicated that the predominant bedrock aquifer underlying Middlesex County is the Passaic Formation. The Passaic Formation can be a confined or unconfined aquifer. Transmissivity values range from 13.37 to 24,062 ft/day with median values of 534.72 ft/day with 43 watersheds or wells tested. Storage characteristics of the Triassic units are governed by fracture spacing, the frequency of bedding planes, and primary (intergranular) porosity. Aquifer tests in fractured shale of the Brunswick Group (of which the Passaic Formation is the oldest member) indicate storage coefficients of approximately 0.0002 (Longwill and Wood, 1965). Regional hydrologic conductivity values range within the Passaic Formation from approximately 29.99 to 2.99×10^{-3} ft/day (Michalski, 1990).

The groundwater moves in the bedrock both vertically and horizontally through systems of interconnected joints and fractures. Locally, the strata are gently warped and broken by a few large faults and many small ones (Michalski, 1990). Systemic fractures (related to regional fracture trendings), both near vertical joints and partings along the bedding, are generally believed to provide the principal passages for groundwater flow through the Passaic Formation (Michalski, 1990). The shales and sandstones are generally capable of sustaining moderate to large yields. Most wells that are screened in this interval draw from more than one water-bearing zone, but the boundaries of the zones have not yet been accurately defined. Some wells penetrate from 400 to 600 feet below ground surface to reach these zones. The best producing wells, however, are 300 to 400 feet deep (Nichols, 1968)

The bedrock aquifer in the region has been found to be anisotropic (it does not transmit water equally in all directions). Water moves more readily along joints and fractures that parallel the strike of the bedding planes, than along joints and fractures that strike in other directions. The strike of the bedding in this area is generally north 30 degrees east. According to Michalski, 1990, the Brunswick Formation (Passaic Formation) conceptually can be described as a "leaky" multi-unit aquifer system, which consists of thin water-bearing units, and much thicker, strata-bound, intervening aquitards. Both the water-bearing units and the aquitards are part of a homoclinal structure, with a typical dip in the range of 5 to 25°. On the whole, such a structure is inherently anisotropic with the low permeability axis oriented perpendicular to bedding. The bedrock aquifer is capped by a weathered zone of lower permeable material (Raritan Fire Clay and Weathered Bedrock).

Banino et al. (1970) noted that in areas underlain by shales or argillites, the groundwater table is prone to periods of drought. A short dry period may cause well levels to drop appreciably, while during extended dry periods, wells may drop to critical levels or cease production. However, the water table recovers rapidly after rainfall. Such behavior is indicative of low capacity for water storage within the rock.

2.3.2 Salt Water Intrusion

Appel (1962) conducted investigations into the effects of salt water intrusion into the aquifers of the Raritan Formation. These investigations were performed just southwest of the study area in Sayreville, New Jersey. As early as 1930, well testing indicated that encroachment of the aquifer by salt water had occurred. By 1943 a majority of wells north of the Raritan River in Perth Amboy were known to be contaminated with salt water (Barksdale et al. 1943). In the early 1960s, widespread salt water encroachment had caused many wells to be abandoned. Overpumping of the aquifer was cited as the cause of the encroachment.

The extent of salt water intrusion into the Farrington Sand Member of the Raritan Formation can be determined by testing for chloride levels in the wells within the Farrington Sand. "Progressive increase in the chloride concentration above the normal chloride content is a significant indication of salt water encroachment" (Appel, 1962). This is because chloride is a major constituent in sea water, but not in groundwater. Appel (1962) cites 5 ppm chloride to be normal for natural freshwaters from the Farrington Sand (distant from areas of contamination), with 10 ppm being indicative of the movement of salt water into the area. The Safe Drinking Water Act maximum level for chloride for potable drinking water is 250 ppm.

2.3.3 Surface Water Hydrology

The dominant hydrologic feature in the vicinity of the study area is the Raritan River. The Raritan River discharges to the Raritan Bay approximately 5 miles east of the former Arsenal. The Raritan River is tidally dominated with the amount of discharge from the Raritan River to the Raritan Bay varying with each tidal cycle. The tide-dominated portion of the Raritan River begins upstream of the study area at Fieldville Dam near New Brunswick. It is divided into three parts: the upper, middle, and lower estuaries. The upper estuary is located between 11 miles and 14 miles upstream of the mouth of the river. Salinity was reported in this area at a concentration of approximately 3 parts per thousand (ppt). The middle estuary is located between 7.5 and 11 miles upstream of the river mouth with salinity ranging up to 19 ppt. The lower estuary is the reach between 7.5 miles and the river mouth, where it empties into Raritan Bay, with salinity ranging from 18 to 21 ppt (Ashley and Renwick, 1983). At the beginning of the lower estuary near the Washington Canal at Sayreville, the river begins to widen to an approximate width of 2,300 feet. The former Arsenal is situated adjacent to the lower estuary.

The Raritan River reaches widths up to 2,500 feet adjacent to the study area. This portion of the Raritan River consists of a low sinuosity reach bordered by an extensive salt marsh and tidal channel complex. Marshes and tidal channels are abundant within the southern portion of the study area. This entire tide-related complex can extend beyond the river banks up to 10,000 feet in width. The lower estuarine reach of the channel contains a sandy bed, though areas of silt and clay are common on the channel margin, as well as in the marsh (Ashley and Renwick, 1983).

Overall, flow within the Raritan River is both "temporally and spatially variable in magnitude and direction" due to the influence of tides (Ashley and Renwick, 1983). Ashley and Renwick (1983) indicate that flow in the lower estuary is strongly reversing with sandy bed sediments being transported both upstream and downstream. Bed shear stresses increase closer to the mouth of the estuary, where tidal influence becomes more dominant. Consequently, sediment transport is greater and less affected by runoff events in this lower area.

The entire estuary has been classified by Renwick and Ashley (1984) as an effective sediment trap as determined from sediment budgets. A sediment trap, or sink, is an area where sediment input (gain) is greater than sediment loss. Velocity within the estuary drops dramatically as the width of the channel increases. This drop in velocity allows finer-grained material to drop from suspension. Renwick and Ashley (1984) state that the estuary is serving as a sediment sink with a sedimentation rate of 1.5 to 3.4 mm/year.

The lower estuary, on which the former Arsenal is situated, contains significant amounts of mud beds (Renwick and Ashley, 1984). The mud consists of sand and mud with organic matter ranging from 1 percent to 11 percent in the sediments. The previously mentioned mud bench is a wide area, typically 1 to 3 meters deep, that in places occupies up to half of the width of the estuary. Dredging occurs in the 300-foot-wide federal navigation channel on the north (former Arsenal) side of the river, to a depth of 25 feet at mean low water at Red Root Creek. The elongate inlands facing the former Arsenal were created by dikes created by the Federal Government. Crab Island was not created in this manner, however. It is a natural feature that appears on 18th century maps. Dredging of the main channel has caused an increase in depth, and resulted in a drop in velocities, allowing fine-grained deposition, even in the thalweg (Renwick and Ashley, 1984). The thalweg is defined as the main channel of the stream, where flow occurs during baseflow conditions, assuming a perennial system. The thalweg is usually noticeably incised, as compared to the rest of the channel. It is the deepest or navigable channel. Adjacent to the former Arsenal, the primary thalweg is on the southern side of the channel, as determined from topographic maps.

A sediment sink has significant environmental implications. Renwick and Ashley (1984) state that "it is clear that the total quantities of pollutants are much greater in bed sediments than in water, and that the sediments function as the main storage for many of these pollutants." Clays and associated organic materials tend to have significantly higher concentrations of pollutants than do coarser materials, up to one or two orders of magnitude higher. Thus, areas of higher concentrations of pollutants will correspond with areas of finer-grained sediments, while adjacent areas of higher velocity with coarser sediments may contain lesser concentrations. These pollutants (specifically metals) are transported in suspension, attached to particles of sediment. Renwick and Ashley (1984) note that re-suspension of the sediments could potentially cause the pollutants to be reintroduced into the water column. Additionally, the strongly reversing currents that are moving sediment around the sink area may be distributing pollutants over a wider range because of re-suspension. The results of a 1988 study by McLaughlin suggest that background levels of contaminants such as lead in the Raritan River may potentially contribute to surface water contamination in tidally influenced areas.

2.4 CLIMATE

Middlesex County is hot in the summer and rather cold in the winter. In the summer, the average temperature is 73° Fahrenheit (F), and an average maximum daily temperature is 83°F. The highest temperature on record, which occurred on 7 July 1957, is 102°F. In winter, the average temperature is 33°F and the average daily minimum temperature is 25°F. The lowest temperature on record, which occurred at New Brunswick on 22 January 1961, is minus 6°F. Precipitation is well distributed throughout the year. Winter precipitation frequently occurs as snow, but the ground does not usually stay covered for more than a few days at a time. Fifty-four percent of total annual precipitation, or 24 inches, usually falls in April through September. The average seasonal snowfall is 17 inches. The greatest snow depth at any one time during the period of record was 19 inches. On the average, 13 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year (Powley, 1987).

In 2 years out of every 10, the rainfall in April through September is less than 21 inches. The heaviest 1-day rainfall recorded during the period was 7.66 inches at New Brunswick on 28 August 1971. Thunderstorms occur on about 25 days each year, and mostly in the summer (Powley, 1987).

The average relative humidity in midafternoon is approximately 54 percent. Humidity is higher at night, and the average humidity at dawn is about 73 percent. Daylight hours are dominated by sunshine 65 percent of the time in summer, and 50 percent in winter. The prevailing wind is from the southwest. Average wind speed is highest, 12 miles per hour, in March (Powley, 1987).

SECTION 3.0

STUDY AREA INVESTIGATION

The Phase 2 RI was performed to confirm the results of previous investigations and to fill data gaps regarding the extent of soil, sediment, surface water and groundwater contamination. The purposes of the Phase 2 RI were to:

- Confirm the results of previous investigations performed by OBG, and Dames & Moore.
- Establish background quality of environmental media (soil, sediment, surface water, and groundwater).
- Define the nature and extent of soil, sediment, surface water, and groundwater contamination, and develop a site-wide conceptual model based on the results of the Phase 2 RI in order to evaluate contaminant migration pathways and receptors.
- Define potential contaminant source areas and identify the need for additional sampling if warranted.
- Support a potential baseline risk assessment and assist in identifying potential remedial technologies in a potential future feasibility study.

The proposed scope of work and technical approach for the Phase 2 RI was developed based on a previous land use study, a review of EMSL historical aerial photographs, a historical record archive search, a review of the results of previous investigations and a preliminary conceptual model of site conditions. Based on these data, WESTON developed two Phase 2 RI work plans for the investigation of 25 AOCs. The first work plan was developed for six AOCs (Area 10/10A, Area 17/17A, Building 118, and Areas X, H, and W) and is dated July 1993. The second work plan was developed for 19 AOCs (Areas 1 through 9, 11, 12, 14, 15, 16/16A, 18 (A-G), 19, 20, Building 151, and Owens-Illinois), and is dated December 1993. The fieldwork for the Phase 2 RI was implemented during five separate field efforts. These five separate field efforts included an expedited preliminary site investigation (SI) of Area 5, performed during June 1993; an expedited soil and groundwater investigation of Area 17 conducted from September to November 1993; a soil and groundwater investigation (including the SGWS investigation) of expedited sites including Areas 4, 10/10A, 18A, X, H, W, and Building 118 conducted from April to June 1994; a soil and groundwater investigation of the remaining 17 AOCs conducted from July 1994 to 16 March 1995; and a sediment and surface water investigation of specific AOCs conducted from August 1994 through February 1995.

The results of the different Phase 2 RI field efforts (i.e., sampling of soil, surface water, sediment and groundwater) have been presented in several different ROIs. The results of the area-specific soils investigation are presented in area-specific ROIs for each AOC. The area-specific soil ROIs present the results of the soil boring program, soil sampling and analytical results, and a detailed discussion of monitoring well construction and development.

The results of the Area 5 SI are presented in the Final ROI Area 5 sampling report dated December 15, 1993. The results of the expedited Phase 2 RI at Area 17, including the results of soil sampling, detailed discussion of monitoring well construction, well development, groundwater sampling and groundwater level monitoring, are presented in the Area 17 draft soil ROI, dated December 1993. Area 17 groundwater sampling results are presented in the Final Area 17 ROI Groundwater Investigation Addendum, dated May 1994.

The results of the Phase 2 RI sediment and surface water investigation, including a discussion of the physical site characterization investigation (i.e., surface water survey, wetland survey, floodplain survey, and preliminary ecological assessment) are discussed in the site-wide sediment and surface water sampling ROI dated May 1995. Brief summaries of the soil, and sediment and surface water investigations are presented in Sections 3.1 and 3.2.

The results of the shallow groundwater screening (SGWS) investigation are presented in the Phase 2 RI Work Plan Addendum dated December 1994 and amended June 1995. A summary of the SGWS investigation is presented in Section 3.3.3.2. The results of the SGWS investigation are discussed in Section 5.2.1.

This site-wide hydrogeology report focuses on the Phase 2 RI groundwater investigation. A summary of the tasks performed during the groundwater investigation and WESTON's overall technical approach is presented below in Section 3.3.

3.1 PHASE 2 RI SOILS INVESTIGATION

The SOW for the Phase 2 RI soils investigation was developed to evaluate the potential for surface and subsurface soil contamination at the AOCs not sampled previously, and to further delineate areas known to be contaminated. Some of these AOCs included historical features potentially related to past Army activities; such as burn areas, ground scars, and mounds of relocated material (i.e., dredge spoils).

During the Phase 2 RI, WESTON performed soil borings to characterize the nature and extent of possible soil contamination at the former Arsenal. In addition, lithologic descriptions were recorded for each sample collected at every boring to assist in characterizing the site stratigraphy. Approximately 1,000 soil samples were collected from 500 soil borings which were drilled within the AOCs previously discussed. Four separate Phase 2 RI soil investigation field efforts occurred between June 1993 and October 1994. These four field efforts included the expedited soil investigations of Area 5, Area 17, and Areas 4, 10, 18A, X, H, W, and Building 118, and the soil investigations of the remaining 17 AOCs . A detailed description of the soil sampling program, numbers of samples collected, analyses requested, and field procedures are presented in the area-specific soil ROIs.

In general, the area-specific soils investigation included collecting soil samples from discrete 6-inch intervals at three distinct depth intervals. The surface samples were, in general, collected from 0- to 6-inches below ground surface (BGS), with the aliquot for VOC analysis being collected from 18 to 24 inches BGS. In areas where fill or reworked soil was evident, a sample was collected from the first 6 inches of natural, undisturbed soil (if encountered). Finally, samples were collected from a "deep" sample interval consisting of the 6-inch interval of soil immediately above the water table (first water), or, a maximum depth interval of 9.5 to 10 feet below the fill/natural soil interface.

All soil samples retrieved from soil borings were screened with a photoionization detector (PID) or equivalent equipment. At locations where metals analysis was requested, 25 percent of all samples were analyzed for TAL metals plus cyanide, and the remaining soil samples were analyzed for PPM plus barium. Evaluation of soil samples for residual explosive compounds was performed using an analytical screening method (Jenkins Method), with a maximum of 10 percent of these samples being submitted for confirmatory explosives analysis (Method 8330). Soil samples were also analyzed for TCL VOC, SVOC, pesticides/PCBs and pH. Selected soil samples were also analyzed for thiodiglycol, dioxin/furan compounds, and feasibility study and geotechnical parameters.

Soil borings were drilled by New Jersey-licensed drillers, including Summit Drilling Co., James C. Anderson Associates and Huntingdon-Empire Soils Investigations, Inc., under the direction of WESTON geologists. Soil borings advanced at the former Arsenal were drilled using either truck-mounted drill rigs, all-terrain vehicle (ATV) drill rigs, or a tripod and mounted hammer. In general, soil borings were drilled using 8-inch-O.D. hollow-stem augers with a center bit, and were sampled continuously in 2-foot depth intervals, unless the physical conditions of the location prohibited this practice. Three-inch diameter, low-carbon steel split spoons were used to ensure that enough volume was obtained for all analytical parameters. Prior to drilling at each location, WESTON's UXO technical escort and support subcontractor, EODT, of Oak Ridge, Tennessee, performed a visual inspection and a surficial magnetometer sweep of the proposed borehole location and cleared ingress/egress routes. As the borings were advanced, EODT placed a magnetometer down the borehole to check for magnetic anomalies at depth. This procedure continued at 2-foot intervals until natural soil was encountered. The purpose of the magnetometer survey was to avoid potential encounters with UXOs.

Each boring was logged and classified by a WESTON geologist utilizing WESTON's GEOLIS™ (Geologic Logging and Interpretation System). Boring location data were entered onto a GEOLIS borehole location sheet, and each sample retrieved from split spoons was described on a borehole logging form. Each sample was classified according to the Unified Soil Classification system (USCS). Soil classification included characterization of soil texture (i.e., gravel, sand, silt, and clay percentages); color; moisture content; relative density (drilling blow counts); sorting; plasticity; and other pertinent information as listed on the GEOLIS lithologic logs. After fieldwork was completed, the GEOLIS Data Management Software (GDMS) was used to enter the data into a data base. Borehole location data sheets and borehole logs for the area-specific soil boring program are presented in Appendix A of the soils ROI for each AOC.

In general, geotechnical soil samples were collected using stainless steel inserts within standard three-inch-diameter split spoon. Soil samples were collected for geotechnical analysis from a 2-foot depth interval using the same sample identification as the environmental sample. Geotechnical soil samples obtained from soil borings were collected from an interval straddling the same interval as the environmental sample, but were collected from a boring immediately adjacent to the boring (co-located sample) from which the environmental sample was collected or from a 2-foot depth immediately below the environmental sample. In general, geotechnical soil samples obtained from monitoring well borings were collected using a Shelby tube from specific 2-foot depth intervals based on geologic conditions. Once the geotechnical samples were retrieved the inserts or Shelby tubes were capped, cleaned, sealed (waxed on each end and taped) to protect the integrity of the samples, packaged and shipped to the laboratory.

Upon completion of drilling, logging and sampling, each boring was backfilled with soil cuttings. Any additional soil cuttings were spread out on the ground surface adjacent to the borehole in accordance with the approved waste management plan. All soil borings were surveyed for elevation to the nearest hundredth of a foot and for horizontal position utilizing the New Jersey state plane coordinates (NAD 83) to the nearest 1 foot. The survey subcontractor, GEOD Corporation, is a licensed New Jersey land surveyor.

3.2 PHASE 2 RI SEDIMENT AND SURFACE WATER INVESTIGATION

The primary objective of the site-wide Phase 2 RI sediment and surface water investigation was to provide a comprehensive evaluation of the extent of sediment and surface water contamination over the entire former Arsenal site. Previous studies conducted by OBG, and Dames & Moore had focused on limited areas and analyses. Moreover, while previous investigations had been conducted on the history of activities at the former Arsenal, as well as resource characteristics, these studies required updating and integration with sediment and surface water sampling results to ascertain potential contaminant migration pathways. During the investigation, surface water and sediment samples were collected at 114 and 132 locations, respectively, at the former Arsenal, and analyzed for a standard set of parameters, including VOC, SVOC, pesticides/PCBs, priority pollutant metals, explosives, and physical parameters (grain size, total organic content, pH). In addition, selected locations were analyzed for dioxin/furan compounds, thiogdiglycol, target analyte list metals, and cyanide. Soil samples were collected at eight locations in Area

WESTON

10 and analyzed for the same "standard" parameters, with the exception of physical characteristics.

At 30 of the 114 surface water sampling locations, water samples were collected during both high and low tide periods in order to ascertain potential effects of the Raritan River on contaminant levels. Both "high" and "low" tide samples were collected on the same day, so that comparisons between tidal periods at a given location were unaffected by precipitation or other variables which could differ between days.

Low tide samples were collected as close as possible to mean slack tide. This period was easy to identify, as most of the tidal creeks sampled ran nearly dry. High tide samples were collected when water levels were close to the high water marks on vegetation or creek embankments. High tide water sampling was usually initiated at least 4 hours after the low tide samples were collected, but this delay was not always necessary. Water levels at some locations fluctuated from minimum to maximum levels very quickly.

The results of the sediment and surface water investigation are presented in detail in the Site-Wide Sediment and Surface Water Investigation dated May 1995.

3.3 PHASE 2 RI GROUNDWATER INVESTIGATION

The Phase 2 RI groundwater investigation was designed to provide groundwater quality data and hydrogeologic information which could be used to characterize the hydrogeology of the entire former Arsenal. This site-wide approach centered on the SGWS investigation (which identified potential VOC source areas), a monitoring well network consisting of existing monitoring wells, (previously installed by OBG, Dames & Moore, and Lowe Environmental Sciences, Inc. and others), and newly installed Phase 2 RI monitoring wells. The locations of existing and newly installed monitoring wells are presented on Figure 1-2. The boring logs of the existing and newly installed monitoring wells were used during the stratigraphical investigation to characterize site-wide geology and hydrogeology. Groundwater sampling and groundwater level monitoring of the monitoring well array were used to evaluate site-wide water quality, groundwater flow direction and hydraulic gradients. This site-wide approach was developed to provide groundwater data for the entire former Arsenal which could be integrated with data from the sediment and surface water and area-specific soils investigations. The data were then evaluated to establish a site-wide understanding of the distribution and nature and extent of contamination, potential source areas, and contaminant migration pathways.

The Phase 2 RI work plans address 25 AOCs at the former Arsenal and present the proposed groundwater investigation based on an area-specific format; however, it is important to note that, in many cases, information gathered from one monitoring well location may have been utilized to evaluate more than one area or areas. This is consistent with the site-wide approach discussed in the work plan for the overall groundwater investigation. WESTON's technical approach involved evaluating the existing monitoring well network to determine whether it was appropriate to sufficiently delineate the vertical and horizontal extent of VOC contamination. Based on this evaluation, WESTON proposed to utilize the Geoprobe method to collect shallow groundwater samples for VOC analysis. The SGWS investigation was designed to assist in delineating VOC contamination and identify potential source areas. The results of the SGWS investigation were to be used to develop a Work Plan Addendum for further site investigations.

During an initial review of existing data and previous investigations, WESTON identified a total of 85 monitoring wells reported to be present at the former Arsenal which could potentially be used during the Phase 2 RI. Twelve of these monitoring wells have been excluded from the Phase 2 RI. These include abandoned wells, wells that could not be located, and other wells that were stated as being present but for which locations, logs and construction specifications were not available. Therefore, the Phase 2 RI work plans proposed incorporating a total of 73 existing monitoring wells into the groundwater investigation. Fifty-seven of the monitoring wells were installed as part of either the initial OBG investigation or Dames & Moore's Phase 1 investigation of the former Arsenal, and 13 were installed as part of smaller investigations performed by property owners at Building 151 and Area 18. Three wells installed by Lowe Environmental Services, Inc. as part of EODT's investigation of Area 5 were also incorporated into the Phase 2 RI monitoring well network.

Based on the historical data, existing monitoring well array and the preliminary conceptual model of site geology and hydrogeology, WESTON proposed the installation of 71 additional monitoring wells (four of which were also proposed to be used as pumping wells for hydraulic conductivity testing) and 12 observation wells. The additional monitoring wells were installed to meet the following objectives:

- Supplement the existing monitoring well array.
- Address new areas of concern identified during review of historical data.
- Monitor aquifer zones (lower sand and bedrock) not being monitored by existing monitoring wells.
- Provide coverage in areas of concern without monitoring wells.

The proposed Phase 2 RI monitoring well array was designed to further evaluate the vertical and horizontal extent of contamination in groundwater and to provide groundwater elevation data. In some cases, monitoring well couplets or triplets were proposed to evaluate groundwater quality in distinct water-bearing zones. In areas where groundwater contamination was only suspected, only one monitoring well was proposed, and in areas where contamination had been detected in the overburden zone, monitoring well couplets or triplets were proposed. In addition, four monitoring well couplets (consisting of one overburden monitoring well and one bedrock monitoring well), were proposed to be installed at upgradient locations in order to evaluate background groundwater quality conditions.

The Phase 2 RI Work Plans proposed using a total of 144 existing and proposed monitoring wells during the implementation of the Phase 2 RI groundwater investigation. Each of these monitoring wells was to be used for the supplemental hydrogeologic investigation to develop the site-wide conceptual model and to collect groundwater samples to evaluate groundwater quality.

The tasks performed by WESTON during the Phase 2 RI groundwater investigation at the former Arsenal included the following:

- Performance of a SGWS investigation using the Geoprobe® method, to collect a total of 142 shallow groundwater samples.

- Completion of a stratigraphical investigation including the evaluation of boring logs for existing and newly installed monitoring wells and development of a conceptual model of site-wide geology and hydrogeology.

- Installation and development of 53 new overburden monitoring wells, including five observation wells and four background water quality monitoring wells.

- Installation and development of 20 new bedrock monitoring wells including four background water quality monitoring wells.

- Collection of rock cores from each of the twenty bedrock monitoring wells. Collection of soil samples from selected monitoring wells for geotechnical parameter analysis, in order to evaluate the physical characteristics of the Meadowmat unit, the Lower Sand unit, the Raritan Fire Clay, and Bedrock.

- Installation of 17 staff gauges in suspected tidally influenced and upgradient locations.

- Surveying of all existing and newly installed monitoring wells and staff gauges.

- Completion of three rounds of groundwater level monitoring from 140 existing and newly installed monitoring wells and 17 staff gauges on 3 November 1994 (Round 1), 19 January 1995 (Round 2), and 16 March 1995 (Round 3).

- Completion of two tidal influence investigation monitoring events which coincided with the Round 2 and Round 3 groundwater level monitoring events. Eighteen monitoring wells and 12 staff gauges were monitored during the first tidal influence monitoring event, and 19 monitoring wells and 12 staff gauges were continuously monitored during the second tidal influence monitoring event.

- Collection of 119 groundwater samples from existing (46 wells) and newly installed (73 wells) monitoring wells during the Round 1 groundwater sampling event performed in November 1994.

- Collection of groundwater samples from 62 newly installed monitoring wells and four existing (MW-40, MW-65, MW-66 and MW-67) monitoring wells during the Round 2 groundwater sampling event performed in December 1994.

- Collection of Quality Assurance/Quality Control (QA/QC) samples to evaluate field decontamination procedures, and the quality, accuracy, and precision of laboratory procedures and methodologies.

- Completion of a surrounding well-use survey for all irrigation, monitoring, domestic supply and industrial supply wells within 2 miles of the outer boundary of the site, and all industrial, public supply wells, and wells with water allocation permits within 5 miles of the outer boundary of the site.

- Completion of a preliminary review of non-Army and off-site potential sources of contamination.

All work proposed in the Phase 2 RI work plans was completed on 16 March 1995, with the exception of the following tasks:

- The installation and sampling of two of the five groundwater monitoring wells (PW-23A and PW-23B) associated with Area 12 were not performed during the Phase 2 RI. The installation of these wells is pending the completion of the UXO investigation for Area 12. In addition, the installation of two monitoring wells (PW-41A and PW-42A) associated with Area 18C and the groundwater sampling of all monitoring wells associated with Areas 18B through 18G was not performed during this investigation. This groundwater investigation will be implemented pending approval of the final Work Plan Addendum.

- Three of the six proposed groundwater level monitoring events were not performed (see Section 3.3.5.4).

- Two of the four proposed tidal influence investigation events were not performed (see Section 3.3.5.5).

- Hydraulic conductivity testing was not conducted (see Section 3.3.5.6).

All tasks performed during the Phase 2 RI groundwater investigation, including fieldwork, laboratory analysis and QA/QC procedures, were performed following WESTON's Final Phase

2 RI Work Plans, Chemical Data Acquisition Plans (CDAP), Unexploded Ordnance (UXO) Plans, and Site Safety and Health Plans, dated July and December 1993. Modifications to the Final Phase 2 RI Work Plan were agreed upon by USACE KCD, NJDEP, and USEPA prior to mobilization. These modifications are documented in a memorandum of agreement prepared by USACE dated March 28, 1994. Any deviations from the approved work plan and approved modifications are discussed in Section 3.3.5.

A discussion of the tasks performed during the Phase 2 RI groundwater investigation is presented in the following sections.

3.3.1 Monitoring Well Construction

The following sections present a summary of monitoring well construction for existing wells installed during previous investigations by OBG, Dames & Moore, and Lowe and newly installed Phase 2 RI monitoring wells installed by WESTON.

Specific monitoring well construction details and development data, boring logs and monitoring well construction diagrams for each of the existing monitoring wells are presented in individual reports prepared by OBG, Dames & Moore, and Lowe. Although 13 monitoring wells installed during site investigations by property owners were incorporated into the Phase 2 groundwater investigation, the construction details for these wells are not discussed below.

Specific monitoring well construction details and development data for the 73 newly installed Phase 2 RI monitoring wells are presented in the soil investigation ROIs for Areas 1 through 20, Owens-Illinois, and Areas X, H, W and Building 118. Borehole location data sheets, borehole summaries, and borehole logs for all newly installed Phase 2 RI monitoring wells are presented in Appendix A, and monitoring well completion summaries are presented in Appendix B of this report.

A summary of monitoring well construction specifications for all existing and newly installed monitoring wells incorporated into the Phase 2 RI is presented in Table 3-1. Monitoring well locations are presented on Figure 1-2.

A general discussion of monitoring well construction for existing and newly installed monitoring wells is presented below.

3.3.1.1 Previously Installed Monitoring Wells

During previous investigations at the former Arsenal, OBG, Dames & Moore and Lowe installed a total of 60 overburden monitoring wells. Thirteen monitoring wells were installed as part of other investigations by property owners. Prior to implementing the Phase 2 groundwater investigation, WESTON conducted a survey of the 73 existing monitoring wells proposed to be used during the groundwater investigation, to document mapping inaccuracies and the external condition of the wells. Based on this survey, six existing monitoring wells were dropped from the Phase 2 investigation. These monitoring wells included five wells installed by OBG (MW-4, MW-5, MW-35, MW-36, MW-37), and one well installed by a property owner at Building 151 (MW-SA-2). Monitoring wells MW-4 and MW-5, historically located in Area 9, were dropped because they could not be located and were assumed to have been destroyed during construction activities in the area. These monitoring wells were not replaced, since they were only proposed to be used during groundwater level monitoring and a sufficient number of adjacent wells could be used in their place. Monitoring wells MW-35, MW-36, ad MW-37 historically located in Area 15 were dropped from the investigation because they could not be located and were assumed destroyed during construction of Building 100. WESTON replaced these three wells with monitoring wells MW-83A, MW-84A, and MW-85A. The remaining monitoring well (MW-SA-2) located in the Building 151 AOC was observed to be severely damaged and could not be used for groundwater sampling or groundwater level monitoring. WESTON replaced this well with monitoring well MW-81A.

3.3.1.1.1 O'Brien & Gere Monitoring Wells

As part of an initial contaminant assessment investigation at the former Arsenal, OBG subcontracted Empire Soils Investigations, Inc. to drill and install 30 overburden monitoring wells (MW-4 to MW-22, MW-25 to MW-31 and MW-34 to MW-37). This field effort took place between 14 September and 21 December 1988, and the logs were provided in the Final Engineering Report, Former Raritan Arsenal (August 1989). The purpose of this investigation was to collect groundwater quality data and evaluate groundwater flow direction with respect to the unconsolidated water table aquifer.

Each monitoring well was constructed of 4-inch-diameter, schedule 40 PVC well screen (0.01-inch openings [10 slot]) and riser casing. The screened intervals varied in length from 2.5 feet to 34 feet. In some instances, more than one stratigraphical unit was screened. The filter pack for each well consisted of #0 Morie sand and an approximate 2-foot bentonite seal (bentonite pellets) was emplaced above the filter pack. Three monitoring wells (MW-16, MW-31 and MW-34) were constructed with bentonite pellets and a bentonite slurry (to just below ground surface). The slurry was used to seal off the formation encountered above the meadowmat layer.

Well completion consisted of installation of locking protective casings and the construction of concrete pads. Well development was done using a surge and pump technique. A surge block was lowered into each well, and the well screen interval was surged for approximately 10 minutes. The surge block process was followed by pumping the well until the discharged water appeared to be sediment-free (approximately 10 to 20 minutes).

3.3.1.1.2 Dames & Moore Monitoring Wells

As part of a Phase 1 RI at the former Arsenal, Dames & Moore subcontracted Empire Soils Investigations, Inc. to drill and install 27 overburden monitoring wells (MW-40, MW-42A, MW-43 to MW-45, MW-46A, MW-47A, MW-48A/B, MW-49 to MW-51, MW-52A/B, MW-53, MW-54, MW-55A/B, MW-56 to MW-64). This field effort took place from March to July 1992, and the logs were provided in the Preliminary Report Phase 1 Remedial Investigation of Selected Areas of the Former Raritan Arsenal (Volume III).

Each well was constructed of 2-inch-diameter, schedule 40 PVC well screen (0.01-inch openings [10 slot]) and riser casing. The screened intervals varied from 2.0 feet to 25 feet in length. In some cases, more than one stratigraphical unit was screened. The filter pack consisted of #1 Morie sand that was tremied into place around the well screen to approximately 2 feet above the top of the screen. A 2-foot-thick (approximate) bentonite seal was installed above the filter pack and a cement-bentonite grout was emplaced above the seal to a depth of approximately 2 feet BGS.

Locking, protective outer steel (or PVC) casings were placed over each of the PVC well casings and grouted into place. The wells were completed in a 4-foot-square, 4-inch-thick concrete pad, with three 2-inch-diameter steel posts surrounding the well for protection. Monitoring well permits were obtained for each well prior to the installation of that well, and identification tags were attached to the protective casings.

Well development was performed no sooner than 48 hours after well installation. Each well was mechanically surged a minimum of three times, after which a quantity of water equivalent to one well volume was purged using a pump. This process continued until the discharged water exhibited turbidity measurements less than 50 nephelometric turbidity units (NTU).

3.3.1.1.3 Lowe Environmental Monitoring Wells

Lowe Environmental Inc. and Huntingdon-Empire Soils Investigations, Inc. were subcontracted by EODT Inc. to drill and install three overburden monitoring wells (MW-65, MW-66 and MW-67) as part of an initial investigation of Area 5. This field effort took place between 14 June and 9 July 1993. A summary of the Area 5 investigation is presented in the Final Report for Boring/Monitoring Well Installation (August 12, 1993) prepared by Lowe Environmental Inc. Each monitoring well was constructed of 2-inch-diameter, schedule 40 PVC well screen (0.01-inch openings [10 slot]) and riser casing. The screened intervals were 10 feet in length, and two of the wells (MW-65 and MW-67) screened more than one stratigraphical unit. The filter pack consisted of #0 Morie sand that was tremied into place around the well screen to approximately 2 feet above the top of the screen. An approximate 2-foot-thick bentonite seal (pellets) was placed above the filter pack in all OBG wells (except in MW-66). In monitoring well MW-66, the bentonite seal extended to the ground surface. A concrete pad (3 feet square and 4 inches thick) was constructed at the ground surface around the lockable protective steel casing.

The wells were developed by pumping with a centrifugal pump using a new dedicated plastic suction hose. The suction hoses were steam-cleaned prior to use. Well development consisted of alternate pumping and surging (with a surge block). The typical procedure was to pump until the water ran clean, surge for 8 to 10 minutes and pump again.

At monitoring well MW-65, a total of 850 gallons of water were pumped. At the completion of pumping the water was clear. Generally, 100 gallons were pumped and then the surge block was used. Pumping rates varied from 5 to 14 gallons per minute. Recharge was equal to the pumping rate. No change in water level could be detected.

At monitoring well MW-66 a total of 1400 gallons of water were pumped. At the completion of pumping the water was clear. Generally, 150 to 175 gallons were pumped and then the surge block was used. Pumping rates varied from 16 to 25 gallons per minute. Recharge was equal to the pumping rate. No change in water level could be detected.

At monitoring well MW-67 a total of about 40 gallons of water were pumped. This well did not have enough recharge to provide for sufficient development. It could be pumped dry in about 1 to 2 minutes and would take several hours to recharge. All water that was pumped (before and after surging) was turbid with a discolored or muddy appearance.

3.3.1.2 Phase 2 RI Groundwater Monitoring Wells

The Phase 2 RI work plans proposed the installation of 71 monitoring wells and 12 observation wells. Proposed monitoring wells designated with an "A" were considered shallow wells to be screened across the water table. However, based on USEPA comments to the Phase 2 RI work plans, all overburden monitoring well screens were to be set with the top of the screen below the water table unless floating product was encountered. Proposed monitoring wells designated with a "B" were to be screened within the lower sand and below a peat unit if encountered. All new overburden monitoring wells were to be installed with 2-inch PVC well materials, with well screens no greater than 15 feet in length. Most wells were to be installed with 10-foot well screens; however, at several locations 15-foot well screens were proposed. In addition, 15-foot well screens could be used if it would enable the monitoring well to monitor the entire saturated thickness of a particular lithologic unit. If confining layers or suspected contamination were encountered during drilling of overburden monitoring wells, precautionary measures were proposed to prevent possible cross contamination. These precautionary measures included extending the bentonite seal from the top of the sand pack to the top of the confining layer or placing outer casing from the surface into the confining layer.

Proposed monitoring wells designated with a "C" were to be bedrock monitoring wells. All new bedrock monitoring wells were to be constructed as 4-inch-diameter open hole monitoring wells. The inner casing was to consist of 4-inch schedule 40 or 80 PVC well casing. All bedrock monitoring wells drilled in areas containing a potential confining layer were to be double-cased. Bedrock wells were proposed to characterize the bedrock aquifer which had not been evaluated during previous investigations. They were located in areas in which contamination was previously detected in the overburden, but were also spread out across the site to provide adequate overall hydrogeologic coverage for the former Arsenal.

During the Phase 2 RI groundwater investigation, WESTON installed 68 monitoring wells and 5 observation wells (total 73 wells). These monitoring wells were installed during three separate field efforts implemented from Fall 1993 to November 1994. Four of the 73 monitoring wells were installed during the expedited Phase 2 RI at Area 17, and 9 of the 73 monitoring wells were installed during a second expedited Phase 2 RI at Areas 4, 10, X, H, W, 18A and Building 118. The remaining 60 monitoring wells were installed during the investigation of the remaining 17 AOCs. Five of the monitoring wells installed during the Phase 2 RI were replacement wells for existing monitoring wells that were damaged or destroyed.

Fifty-three of the monitoring wells were installed in the overburden to monitor the groundwater quality and flow patterns. The remaining 20 monitoring wells were installed in the bedrock formations (i.e., PAS and PAL) to provide information about the lithology, extent of weathered bedrock, thickness of potential confining units (i.e., Raritan Fire Clay), and the nature and extent of any groundwater contamination. Eight of the 73 wells (4 overburden and 4 bedrock) were installed to monitor background quality of groundwater. Five of the overburden wells were installed as observation wells. Two of the monitoring wells were constructed as pumping wells.

A total of 13 soil samples were collected for geotechnical analyses (i.e., Shelby tubes) from monitoring well borings so that the physical characteristics of potential confining units and the saturated, sandy zones could be quantified. As stated in Section 3.1, geotechnical soil samples were also collected during drilling of soil borings as part of the Phase 2 RI soils investigation.

All of the monitoring wells installed during the Phase 2 RI were surveyed by GEOD, Inc., a New Jersey licensed surveyor, including all horizontal locations, ground surface elevations, top of inner PVC casing elevations and top of outer protective casing elevations. The elevations were reported to the nearest hundredth of a foot. Location coordinates were provided in the New Jersey State Plain Coordinate System (NAD 83) and are based on first order survey monuments.

A detailed discussion of the specific well construction details for each newly installed Phase 2 RI monitoring well is provided in the area-specific soils ROIs. Monitoring well construction specifications are summarized in Table 3-1. Monitoring well completion summary diagrams are presented in Appendix B. A summary of proposed Phase 2 RI monitoring well identification numbers (PW-1A) cross referenced to actual monitoring well identification numbers (MW-74B) assigned in the field is presented in Table 3-2.

3.3.1.2.1 Overburden Monitoring Wells

In general, each overburden monitoring well was drilled using 8-inch-O.D. (6.75-inch-I.D.) hollow-stem augers, and split-spoon samples were collected to evaluate lithology and the zone(s) of groundwater saturation. Prior to reaching the borehole completion depth, a decision was made as to what interval of the formation was to be screened. Although two types of overburden monitoring wells were proposed (i.e., "A" and "B") for two separate zones of groundwater monitoring, in general, the shallow "A" zone was not encountered. The shallow "A" zone was described as the first water encountered and is usually encountered above the MM unit. Monitoring wells MW-63A, MW-76A and MW-100A were the only Phase 2 RI wells constructed that met the proposed criteria (i.e., screened in a water-bearing zone above a meadowmat unit). Existing wells MW-25, MW-28, MW-29 and MW-30 were also screened entirely in the US unit. The remainder of the "A" wells were constructed as "first water" wells in and/or below the meadowmat layer (if present) and within the LS. Table 3-1 presents the monitoring well construction details and specifications. In addition, the table indicates where the wells are screened and what hydrologic zone the wells monitor.

All of the "B" wells were installed in the LS unit. In cases where locations contained well couplets or triplets, and no true "A" groundwater zone was present, the "A" and "B" wells were installed with the intention of screening the entire saturated thickness of the LS unit. Where possible, this approach often warranted installing well screens that were 15 feet in length or less than 10 feet. At these locations the "A" well was screened at the top of the LS under water table conditions or below the MM unit, and the "B" well was installed at the bottom of the LS unit above Raritan Fire Clay, clay, saprolite, or bedrock.

Well construction materials consisted of 2-inch-diameter, schedule 40 PVC, well screens and riser pipe. The monitoring wells were constructed with 0.010-inch (10 slot) well screens and varied in length according to the interval of interest. The well screens ranged in length from 3 feet to 15 feet. The annular space between the well screen and the formation was filled with filter pack (Morie #0 or #1) to an elevation approximately 2 feet above the top of the screen. The remaining filter pack consisted of approximately 1 foot of finer sand (Morie #000 or #0) on top of the #0 or #1 filter pack. This fine filter pack was designed to act as a sand choke between the formation material and the well materials, as well as to impede any potential for grout to enter the well from above. The filter pack never extended beyond the top of the aquifer to be monitored.

A bentonite seal was emplaced above the filter pack to prevent infiltration of the cement grout into the filter pack and well screen. The seals varied in thickness depending on the stratigraphy at that location, but were always a minimum of 2 feet thick. In general, if the seal was emplaced below the water table, then bentonite pellets or chips (holeplug) were used. If the seal was located above or at the elevation of the water table, then a bentonite slurry was used (bentonite powder mixed with potable water). At locations where a potential confining unit was encountered, precautionary measures were taken to prevent cross contamination. If water was encountered within the US unit above a MM unit of significant thickness, the bentonite seal was extended to the top of the MM unit.

A cement-bentonite grout mixture was placed above the seal and extended to approximately ground surface. Well completions for the overburden monitoring wells consisted of both flush-mount construction and aboveground protective steel "stick-up" casings. Cement pads were constructed around each well (and protective casing) to provide drainage away from the wells. Protective PVC caps were placed on the PVC riser pipe and vent holes were drilled in the caps. Locks were placed on the outside of the protective casings, and weep holes were drilled just above the cement pads to provide drainage from the protective well casings. Metal tags with the monitoring well I.D. number and the NJDEP well permit number were affixed to the protective casings or manhole covers. Steel posts were installed around each well to protect the well stick-ups. Flush-mounted wells had locking vacuum caps placed at each location. A concrete pad was constructed and a flush-mounted manhole cover was grouted in place to secure these locations.

3.3.1.2.2 Bedrock Monitoring Wells

All bedrock monitoring wells were designated "C" wells and were intended to characterize the bedrock aquifer. The boreholes were advanced until bedrock refusal was encountered. Drilling continued using an HQ, NQ or NX size wireline core-barrel sampler until the borehole extended a minimum of 10 feet into competent bedrock. The borehole was then reamed with an 8-inch roller bit and 4-inch-diameter, schedule 80 PVC casing was installed from ground surface to approximately 10 feet into competent bedrock.

The bedrock wells were drilled using hydraulic rotary techniques (i.e., mud or air), but in some cases, the boreholes were begun using hollow-stem augers to drill in the overburden. At certain locations, boreholes were double-cased or triple-cased, using 8-inch, 10-inch and/or 12-inch steel casing as the intermediate and outermost casing(s). These sections of steel casing were installed to either provide a surface seal (i.e., prevent borehole collapse, prevent problems with running sands, or preclude loss of drilling mud circulation to the ground surface) or to seal off an upper water-bearing zone(s) from a lower water-bearing zone. Six of the wells were single cased, 12 of the wells were double-cased, and two wells were triple-cased.

The annulus between the well casing(s) and the borehole wall was grouted using a cement-bentonite mixture that functioned as a seal for the formation and held the casing permanently in place. The grout pumped to the bottom of the borehole using a tremie pipe was allowed to cure for a minimum of 24 to 48 hours (depending on the field effort) before drilling below the casing(s) continued.

Once the grout had set, the bedrock below the casing was cored using either HQ (3.81-inch-diameter), NQ (2.98 inch diameter) or NX (3.0 inch diameter) core barrels. Typically, potable water was used as the drilling fluid while coring. The rock core samples were obtained to evaluate whether the rock was competent enough to set the inner PVC well casing, to evaluate the physical properties of the bedrock, and to identify potential water-bearing fractures. In general, the open-hole interval extended 10 feet below the outer PVC well casing. However, based on a review of the rock cores, if significant potential water-bearing fractures were not identified, the open-hole was extended an additional 15 feet. After 10 feet of open hole was drilled and the rock cores were evaluated, a decontaminated submersible pump was used to purge water from the borehole and evaluate recharge (approximate yield for the well). Based on this final evaluation, the open hole was either extended an additional 15 feet or the well was completed. In general, when HQ cores were used, the open-hole was not reamed with a larger diameter roller bit. With the exception of monitoring wells MW-71C, MW-75C, and MW-76C, all open-hole intervals drilled with NX or NQ core barrels were reamed with a 3.75-inch roller bit prior to well completion. The open-hole interval for monitoring wells MW-71C, MW-75C, and MW-76C were not reamed, and the final open-hole diameter for these wells was approximately 3.0 inches.

Well completions for the bedrock monitoring wells consisted of both flush-mount construction and aboveground protective steel "stick-up" casings. Cement pads were constructed around each well and/or protective casing to provide drainage away from the wells. Protective PVC caps were placed on the PVC riser pipe, and vent holes were drilled in the caps. Locks were placed on the outside of the protective casings, and weep holes were drilled just above the cement pads to provide drainage from the protective well casings. Metal tags with the monitoring well I.D. number and the NJDEP well permit number were affixed to the protective casings or manhole covers. Steel posts were installed around each well to protect the well stick-ups. Flush-mounted wells had locking vacuum caps placed at each location. A concrete pad and flush-mounted manhole cover were grouted in place to secure these locations.

3.3.1.2.3 Pumping Monitoring Wells

The work plan proposed that three of the monitoring wells be used as pumping wells during proposed hydraulic conductivity testing. Based on field conditions encountered during the Phase 2 RI, the preliminary site-wide conceptual model was revised. As a result, only two of the proposed monitoring wells to be used as pumping wells were installed or constructed as pumping wells. These two monitoring wells, consisting of one overburden monitoring well (MW-79B) and one bedrock monitoring well (MW-79C), were installed to monitor groundwater levels and groundwater quality and were constructed so they could be used as pumping wells during future hydraulic conductivity testing. These wells were installed along Olympic Drive in Area 8.

Overburden monitoring well MW-79B was constructed of 6-inch-diameter, flush-jointed schedule 80 PVC well casing with a continuous wrapped 0.020-inch slot well screen. The casing extended from 2.34 feet above ground surface (AGS) to 18 feet BGS, with 10 feet of well screen set from 18 to 28 feet BGS.

The filter pack in overburden monitoring well MW-79B consisted of #0 Morie well sand, which was slowly poured into the borehole while the augers were removed. The top of the filter pack was measured using a weighted tape to ensure proper placement. Approximately 2 feet of fine #000 Morie sand, was then placed on top of the #0 well sand. A 4-foot bentonite seal was placed above the filter pack. The bentonite pellet seal was allowed to hydrate for approximately one-half hour prior to grating. Grout (cement-bentonite) was tremied from the top of bentonite seal to the surface.

Bedrock monitoring well MW-79C was drilled using mud-rotary drilling methods to bore the overburden and bedrock holes. The boring in the overburden was drilled using a 12-inch-O.D. drag bit, and an outer casing consisting of 12-inch low-carbon steel was installed to provide a surface seal to prevent the loss of drilling fluid. A 10-inch-O.D. drag bit was then used to drill in the overburden until bedrock was encountered. Refusal on bedrock using the drag bit occurred, and an HQ-core barrel was used to obtain bedrock cores.

Upon confirmation of competent bedrock, a 10-inch, tri-cone roller bit was used to drill into the bedrock. A 6-inch-diameter flush-jointed schedule 80 PVC well casing was then set in the 10-inch borehole. The schedule 80 PVC casing was installed 10 feet into competent rock using a cement-bentonite grout which was pumped to the bottom of the borehole using a tremie pipe. In accordance with USACE SOW, the cement-bentonite grout was allowed to cure for at least 48 hours before the open-hole interval was drilled.

Drilling continued using an HQ-core barrel until a 15-foot interval of bedrock had been cored. A 6-inch-diameter open hole was then reamed from 48 to 63 feet BGS using a 5.87-inch tri-cone roller bit. To facilitate the proposed hydraulic conductivity testing at this well and to preclude the possibility of the collapse of the bedrock formation on the pump, 4-inch-diameter well screen and casing were installed inside the well. Four-inch-diameter flush-jointed schedule 80 PVC (continuous wrapped) 0.020-inch (20 slot) well screen was set from 48 to 63 feet BGS.

A filter pack (Morie #1) sand was slowly poured into the annular space between the borehole and the well screen/casing. The filter pack extended from 20 to 63 feet BGS. The remaining annular space (zero to 20 feet BGS) was sealed using a cement-bentonite grout.

3.3.1.2.4 Observation Wells

As part of the Phase 2 RI work plans, 12 observation wells were proposed to be installed to monitor water levels during proposed hydraulic conductivity testing. The preliminary site-wide conceptual model was revised as actual field conditions were defined. Based on this revision, only five of the 12 proposed observation wells were installed during the Phase 2 RI. Each of the observation wells was installed within the overburden adjacent to MW-79B and MW-79C within Area 8.

The five overburden observation wells were drilled using 8-inch-O.D. hollow-stem augers. As shown on the well completion summaries for observation wells OB-01B, OB-02B, OB-03B, OB-04B and OB-05A, the total depths (drilled) of the boreholes were 32, 29, 29, 34 and 10 feet BGS, respectively.

Each of the five observation wells were constructed of 2-inch-diameter, flush-jointed PVC schedule 40 well casing and 0.010-inch slot well screen. The filter pack in each overburden observation well consisted of #0 Morie well sand, which was slowly poured into the borehole while the augers were retracted. The top of the filter pack was measured using a weighted tape to ensure proper placement. Approximately 1 foot of fine #000 Morie sand was then placed on top of the #0 well gravel. A bentonite seal was emplaced above the filter pack to prevent infiltration of the cement grout into the filter pack and well screen. The seals varied in thickness depending on the stratigraphy at that location, but were always a minimum of two feet thick.

Protective caps (PVC) were placed on all of the well casings, and locking stick-up steel protective casings were installed. A lock was placed on the outside of each steel protective casing. Well pads were constructed at the ground surface of concrete to provide positive drainage away from the well casings. A vent hole was placed in the PVC caps, and a weep hole was drilled in the protective casings above the cement pads to provide drainage from the protective well casings. Metal tags with the monitoring well I.D. number and the NJDEP well permit number were affixed to the protective casings or manhole covers. Steel posts were installed around each well to protect the well stick-ups.

3.3.2 Phase 2 RI Monitoring Well Development

Each of the Phase 2 RI monitoring wells was developed in accordance with the Phase 2 RI work plan except where noted below. Table 3-3 presents a summary of monitoring well development for each of the monitoring wells installed during the Phase 2 RI. Detailed discussions of monitoring well development for each of the monitoring wells are presented in the area-specific soil ROIs. The monitoring well development was performed in order to meet the following objectives:

- Remove materials that may have built up in the openings of the well screen during installation and key the well screen and filter pack into the formation that is being monitored.

- Remove fines from the sides of the borehole that resulted from drilling procedures.

- Stabilize the fine materials that remained in the vicinity of the well to retard their movement into the well, increasing well yield.

- Provide an estimate of the well yield.

In general, monitoring well development was accomplished by overpumping the well using a Grundfos Redi-Flo 2-inch submersible pump. The pump was field-decontaminated, and new dedicated polyethylene tubing was used for the discharge line. To ensure that fine materials were removed during development, the pump intake was raised and lowered across the entire length of the well screen. In addition, the pump was turned off and on and pumped at different rates during development to cause a surge effect in order to remove additional fine materials.

During development, field measurements of temperature, pH, specific conductivity, turbidity and, at some locations, salinity were obtained at the beginning of development, during development and upon completion of development. Observations related to groundwater appearance were also recorded. Specific observations relating to individual monitoring wells are discussed in the area-specific soils ROIs. However, in general no product or significant sheens were noted. Discernable odors (decaying organic material, hydrogen sulfide) and elevated PID readings were noted in a limited number of the monitoring wells (see Table 3-3).

The development procedures for the monitoring wells continued until the following goals were met or exceeded:

- Discharge water became clear.

- Flow rate stabilized.

- At least five volumes of water were removed and the well was pumped for a minimum of 4 hours.

- Field parameters (temperature, pH, specific conductivity) stabilized to less than 10 percent variation.

- Turbidity readings were less than 50 NTUs as determined by a nephelometer.

One or more of the development goals were not met for several monitoring wells (MW-69A, MW-71C, MW-75A, MW-75C, MW-76A, MW-76C, MW-89A, MW-90C, MW-95A, MW-100A, MW-104C and OB-05A) because they were installed within very silty material or did not have sufficient recharge to enable the well to be pumped for a sustained period of time. Several of the monitoring wells with very low yields and very slow recharge (MW-69A, MW-76A, MW-89A and MW-95A) had to be bailed dry over a period of days or weeks in an attempt to meet the development goals (see Table 3-3).

3.3.3 Groundwater Sampling Program

The following sections present a summary of previous groundwater sampling events performed by OBG and Dames & Moore, a summary of the Phase 2 RI SGWS investigation and Phase 2 RI groundwater sampling. Specific details relating to previous sampling events are presented in OBG and Dames and Moore reports. The three Lowe monitoring wells were not previously sampled and were included in the Phase 2 RI groundwater sampling events. The SGWS investigation is presented in WESTON's Work Plan Addendum dated December 1994. The technical approach and field procedures followed during the Phase 2 RI groundwater sampling program are discussed in Section 3.3.3.3. Specific details of groundwater sampling conducted during the expedited Phase 2 soil and groundwater investigation at Area 17 is presented in the Draft Area 17 ROI dated December 1994.

3.3.3.1 Previous Groundwater Sampling Programs

In November 1987, OBG was retained by the USACE-KCD to perform a contamination evaluation of the former Arsenal. The objective of this evaluation was to perform field investigations and to make a determination as to whether chemical and/or ordnance contamination were present at the site. In 1992, Dames & Moore completed a Phase 1 RI of selected areas within the former Arsenal. The intent of the Phase 1 RI was to begin the assessment of the presence and extent of soil and groundwater contamination attributable to operations and activities formerly conducted at the former Arsenal.

During the OBG contamination evaluation, a total of 30 monitoring wells were installed to evaluate groundwater conditions within the former Arsenal. These monitoring wells consisted of 27 shallow monitoring wells averaging 20 feet in depth and 3 deep overburden monitoring wells ranging from 30 to 58 feet in depth. Groundwater samples collected from the 30 monitoring wells were analyzed for VOCs, total and dissolved metals, total petroleum hydrocarbons, explosives and general indicator parameters. Additionally, permeability tests were conducted at seven monitoring wells to provide a general understanding of the aquifer characteristics.

As part of the Dames & Moore RI, a total of 27 monitoring wells were installed. These wells consisted of 21 shallow overburden and 6 deep bedrock monitoring wells. Groundwater samples were collected from the 27 Dames & Moore monitoring wells as well as 25 existing OBG monitoring wells. All groundwater samples were analyzed for VOCs, base neutrals including acid extractable organic compounds, metals, explosives and pesticides.

The results of previous investigations performed by OBG and Dames & Moore conducted at the former Arsenal are summarized in the Phase 2 RI work plans and are discussed in Section 5.0 of this report.

3.3.3.2 Shallow Groundwater Screening Investigation

The primary objective of the SGWS investigation was to sample the first encountered groundwater over a wide area of the former Arsenal so that areas of shallow groundwater containing VOCs could be delineated. Attempts were also made to sample groundwater at deeper intervals near suspected contamination source areas.

The SGWS investigation was designed to be used as a groundwater contamination screening tool incorporating rapid turnaround laboratory analysis of groundwater samples. Since VOC groundwater contamination was determined to be more widespread than other organic compound contamination during the Phase 1 RI, VOCs were selected as the screening parameter. The intention was to delineate VOCs in shallow groundwater and, in conjunction with other hydrologic information, to provide data regarding potential contamination source areas. Initially, sampling locations were established using a 1,000-foot grid system which encompassed the AOCs with known or suspected VOC contamination in shallow groundwater. Additional sampling locations were also located near previously unsampled AOCs. In areas where VOCs were detected, additional samples were collected on a collapsed grid to delineate the extent of the VOCs and to identify potential source areas.

The SGWS investigation was implemented using the Geoprobe® system. The majority of the samples were collected with a van-mounted Geoprobe unit. An ATV Geoprobe unit was employed for those locations where vehicular access was difficult. All samples were collected by Zebra Environmental Corporation personnel under the direct supervision of a WESTON geologist. The SGWS investigation was conducted during the period from 11 April to 23 May 1994. A summary of the SGWS investigation is presented in Table 3-4.

One-hundred and eighty (180) Geoprobe attempts were made to sample the groundwater at 152 locations. Groundwater samples were successfully collected at 143 of the 152 locations. Due to variable lithologic conditions, i.e., silts and clays with low water yield, it was not possible to collect samples at the remaining nine locations. Several attempts were made to sample groundwater at greater depths at the suspected source areas in Areas 1, 2, 3, 7, 18A, and the western portion of Area 19. However, due to the silty nature of the subsurface geology and the limitations of the Geoprobe sampling rig, the screen point fouled with silt and a deep water sample could not be collected for Areas 1, 7, and 18A. All the sampling locations were surveyed by WESTON's surveying subcontractor, GEOD Corporation. Horizontal (northing and easting) locations are reported to North American Datum of 1983 (NAD 83) while vertical (elevation) data are reported in National Geodetic Vertical Datum (NGVD) of 1929.

All SGWS investigation sampling equipment coming in contact with the groundwater was decontaminated prior to commencing a new sampling location. All equipment and tools were decontaminated by first washing with an alconox/water solution followed by high temperature/high pressure rinse (steam cleaner).

All SGWS investigation samples were collected into laboratory-supplied 40 mL vials furnished with teflon caps and septums. Following collection, sample vials were labeled, logged and placed in a cooler maintained at approximately 4 degrees Celsius. Samples were shipped by overnight courier to WESTON's Lionville Analytical Laboratory, located in Lionville, Pennsylvania for chemical analysis. A chain-of-custody form, identifying the collection date and time of each sample, accompanied each sample cooler. All samples were analyzed at the laboratory for USEPA Priority Pollutant VOCs by Methods 8010/8020. Preliminary analytical results were available within 48 hours of laboratory receipt of samples. Additional information on the SGWS sampling is in the WESTON Work Plan Addendum dated December 1994.

3.3.3.3 Phase 2 Groundwater Sampling Program

During the Phase 2 RI two rounds of groundwater sampling were performed. During the first groundwater sampling event (Round 1) performed from 8 to 18 November 1994, 119 groundwater samples were collected from 46 existing and 73 newly installed monitoring wells (not including the observation wells). During the second groundwater sampling event (Round 2) performed from 12 to 16 December 1994, groundwater samples were collected from 63 newly installed monitoring wells and four existing monitoring wells (MW-40, which had been omitted from Round 1, and MW-65, MW-66, and MW-67, installed during the investigation of Area 5 and not previously sampled). Monitoring wells MW-72A, MW-73A, MW-74A, MW-74C (Phase 2 RI monitoring wells) and MW-55A and MW-55B (previously installed Dames & Moore monitoring wells), associated with the expedited investigation of Area 17, were sampled in November and December 1993. Details of the Area 17 groundwater sampling program are presented in the Area 17 soil investigation ROI, dated December 1993. Since all existing monitoring wells have undergone at least one round of groundwater sampling during previous investigations and appropriate Quality Assurance/Quality Control (QA/QC) protocols were followed, only one additional round of sampling was performed at these wells during the Phase 2 RI. The results of all groundwater sampling performed during previous investigations and during the Phase 2 RI are discussed in Section 5.0.

Groundwater sampling was performed no earlier than 2 two weeks after all newly installed monitoring wells were developed. A summary of monitoring well purging data is presented in Table 3-5, and a summary of the Round 1 and Round 2 groundwater sampling events is presented in Table 3-6 and 3-7, respectively. QA/QC sampling during the Phase 2 RI groundwater sampling program is discussed in Section 3.3.3.4.

During the Phase 2 RI groundwater sampling program, all monitoring wells were purged and sampled using low-flow, field-decontaminated Grundfos Redi-Flo II submersible pumps equipped with new dedicated polyethylene teflon-lined discharge tubing. During purging, wells were pumped at a low rate (lower than recharge rate) so that the water levels would not be drawn down below the top of the well screen, or be purged to dryness. During the evacuation of the first well volume, the pump was lowered from the top of the water through the water column to ensure that all stagnant water in the well would be evacuated. After the first well volume was purged, the pump was raised above the top of the screen/open-hole interval, and purging continued until three to five well volumes were removed. Water level measurements were taken to ensure that the water column did not extend below the top of the well screen. It should be noted that numerous previously installed monitoring wells were installed with the well screen straddling the water table; therefore, the pump was within the screened interval, and groundwater was drawn down below the top of the screen. In addition, newly installed Phase 2 RI monitoring wells were screened below the water table; however, wells installed under water table conditions in some cases had only 1.0 to 2.0 feet of saturated thickness above the well screen. Although attempts were made to purge these wells at a low enough rate to avoid exposing the well screen, it was not always possible.

While monitoring wells were purged, water quality parameters including temperature, pH, and specific conductivity stabilized (less then 10 percent variation), and turbidity levels were less than 50 NTUs. In order to meet these goals, in some cases more than three to five well volumes were evacuated. In general, purge rates for Phase 2 RI wells did not exceed the purge rates at which the monitoring wells were developed, if the information was available. This applies to most if not all newly installed Phase 2 monitoring wells. During well purging, groundwater was observed for the presence of discernable odors and visible sheens, and screened with a PID for the presence of VOCs. Additional groundwater quality parameters including Eh (millivolts), salinity, and dissolved oxygen were obtained to provide additional water quality data. In general, water quality parameters were measured at the beginning of purging after each well volume was evacuated and at the completion of purging. Water quality parameters were obtained more frequently for wells requiring the evacuation of large volumes of groundwater. A summary of monitoring well purging, including final water quality parameter data, is presented in Table 3-5.

Purging requirements for low-yield monitoring wells differed from those for the higher yielding wells. Monitoring wells identified as low-yield wells included MW-7, MW-50, MW-54, MW-57, MW-60C, MW-69A, MW-76A, MW-88C, MW-89A, MW-90C, MW-96C, MW-100A and MW-103C. Low-yield monitoring wells MW-7, MW-50, MW-54 and MW-57 were sampled only during the Round 1 groundwater sampling event. A low-yield monitoring well was defined as a well that is screened within a tight hydrologic formation (bedrock with few fractures or overburden unit with large quantities of silts and clays) that produced a small volume of groundwater and that recharged at a slower rate than the rate at which the well was purged. Each low-yield monitoring well was purged at the slowest possible pump rate to avoid overpumping or pumping the well to dryness. However, the slowest possible pump rate was dependent upon the depth of the well and the amount of head above the pump. Therefore, low-yield wells were pumped until all water was purged from the well and allowed to recharge prior to sampling. The recharge rate was then monitored every 2 hours using a decontaminated water level meter. At well locations where the well had recharged to above the well screen or to the original water level within 2 hours, the well was then sampled. If the water level was below the well screen or below the original water level after 2 hours, the rate of recharge was calculated to determine when the well could be sampled. All low-yield wells were sampled within 24 hours of initial purging.

After purging was completed, a final water quality measurement was obtained and the wells were allowed to recharge. After the well had recharged (less than 2 hours) the pump was turned on at a low rate to evacuate the volume of water in the discharge tube, and the pumping rate was adjusted to approximately 100 mL/minute or until laminar flow was obtained. Flow rates varied depending on the depth of the well and the amount of head above the pump; therefore, the 100 mL/minute criterion was not always achieved. In all cases the pump was adjusted to the lowest possible flow rate based on field conditions. During this initial flow rate adjustment, water quality parameters (pH, specific conductivity, temperature, and turbidity) were measured. Groundwater samples were then collected by directly filling Level I quality sample bottles containing the appropriate preservative. The VOC fraction was collected first, and then the remaining parameters were collected. The remaining samples were collected in the following order: metals, TCL extractable organics including explosives, cyanide, and FS parameters (oil and grease, TDS, hardness). The pH of greater than 10 percent of the samples was checked using pH paper to ensure that samples requiring preservation were properly preserved. After the sample containers were filled, they were immediately placed on ice in a cooler and chilled to 4° Celsius (C).

All applicable sampling equipment was decontaminated prior to use, between monitoring wells and after completion of groundwater sampling. All equipment was thoroughly washed with Alconox and potable water, and generously rinsed with deionized water and allowed to air dry. Each submersible pump and power cord was scrubbed with alconox and potable water. The pump was then placed in a plastic (30-gallon container) filled with potable water and turned on until 20 to 30 gallons were pumped. Finally, the pumps were rinsed with deionized water and placed in new plastic bags. Decontaminated equipment was not allowed to come into contact with the ground. Dedicated teflon-lined discharge tubing was used during both purging and sampling events (Round 1 and 2). After each well was sampled during the Round 1 groundwater sampling event, discharge tubing was drained, placed in plastic bags, sealed and labeled with the monitoring well I.D. in which it was used. This dedicated discharge tubing was reused in monitoring wells that were resampled during the Round 2 sampling event.

With the exception of monitoring well MW-68A, which was analyzed only for PPM plus barium and explosives, all 119 groundwater samples collected during the Round 1 sampling event were analyzed for TCL VOC, TCL SVOC, TCL Pesticides/PCB. All 119 samples were analyzed for explosives (Method 8330). In addition, 80 samples were analyzed for PPM plus barium, 39 samples were analyzed for TAL metals, 41 samples were analyzed for cyanide, 38 samples were analyzed for thiodiglycol, and 27 samples were analyzed for oil and grease, TDS, and hardness. Six samples were analyzed for dioxin/furan, and 11 samples were analyzed for NG/PETN (see Table 3-6).

With the exception of MW-68A, which was analyzed only for PPM plus barium and explosives, all 67 groundwater samples collected during the Round 2 sampling event were analyzed for TCL VOC, TCL SVOC, and TCL Pesticides/PCBs. All 67 samples were analyzed for explosives (Method 8330). In addition, 47 samples were analyzed for PPM plus barium, 20 samples were analyzed for TAL metals plus cyanide, 2 samples were analyzed for dioxin/furan, 21 samples were analyzed for thiodiglycol, and 6 samples were analyzed for NG/PETN (Table 3-7).

During the Round 1 and Round 2 groundwater sampling events, only unfiltered groundwater samples were collected, but precautions were taken to minimize turbidity. Turbidity readings were also recorded in order to evaluate analytical results of samples that may have contained elevated turbidity levels.

During the Round 1 sampling event, approximately 33 percent of the groundwater samples were analyzed for TAL metals and cyanide, and 67 percent of the samples were analyzed for PP metals (PPM) and barium. During the Round 2 sampling event approximately 30 percent of the samples were analyzed for TAL metals and cyanide, and 70 percent were analyzed for PPM and cyanide.

The physical and chemical parameters such as pH, TDS, hardness, oil and grease were analyzed in addition to the standard HTW parameters to generate initial data required to evaluate the applicability of potential remedial technologies during possible future feasibility studies.

3.3.3.4 Phase 2 RI Quality Assurance/Quality Control Sampling

QA/QC samples were collected in accordance with WESTON's Final Phase 2 Work Plan and Chemical Data Acquisition Plan (CDAP) dated July and December, 1993, as modified by subsequent USEPA/NJDEP comments. A QA/QC sample collection summary for the Round 1 and Round 2 groundwater sampling events is presented in Tables 3-8 and 3-9, respectively. A summary of QA/QC sampling for the Area 17 groundwater sampling event performed in the fall of 1993 is presented in the ROI for Area 17 soil and groundwater investigation, dated December 1993. The QA/QC sampling program for the SGWS investigation is presented in the Work Plan Addendum.

During the Phase 2 groundwater sampling program, a VOC trip blank was provided for each groundwater VOC sample shipment. A total of 14 trip blanks were prepared and analyzed during the Phase 2 RI. Nine of the 14 trip blanks were collected during the Round 1 groundwater sampling event, and five were collected from the Round 2 groundwater sampling event. The trip blanks were prepared at the analytical laboratory and consisted of sample bottles filled with laboratory-demonstrated analyte-free, distilled, deionized water that was nitrogen purged prior to shipment from the laboratory. Trip blanks were handled, preserved, transported, and analyzed in the same manner as groundwater samples and returned to the laboratory unopened following each day of sampling. The trip blanks accompanied the VOC sample bottles from the laboratory to the field and back to the laboratory in the same cooler.

During the Phase 2 groundwater sampling program, field blanks were collected at the rate of one per day. A total of 14 field blanks were collected. Nine of the 14 field blanks were collected during the Round 1 groundwater sampling event, and 5 were collected during the Round 2 groundwater sampling event. Field blanks were collected after the pumps were decontaminated by placing the pump in a decontaminated (following the same procedures as the pump) stainless steel container filled with laboratory grade (HPCL) water. The pump was turned on and the HPCL water was pumped directly into the level I sample container through Teflon-lined discharge tubing. All field blanks were handled, preserved (for VOC and metals analysis), transported, and analyzed in the same manner as the samples collected in the field that day.

During the Phase 2 groundwater sampling program, blind field QC duplicates were collected at a rate of 1 per 20 groundwater samples collected. A total of 11 (8 from Round 1 and 3 from Round 2) blind QC duplicates were collected and analyzed for the same parameters as required for the groundwater samples. As an additional QA check on laboratory accuracy and precision, a total of 11 QA duplicate samples were collected and submitted to the USACE Missouri River Division (MRD) laboratory for analysis. During the Round 1 groundwater sampling event, QA/QC duplicate samples were collected from the following monitoring wells: MW-49C, MW-59C, MW-60, MW-80A, MW-85A, MW-93B, MW-97B and MW-98A. During the Round 2 groundwater sampling event, QA/QC duplicate samples were collected from the following monitoring wells: MW-99A, MW-101A, and MW-105C.

During the Phase 2 groundwater sampling program, matrix spike (MS) and matrix spike duplicate (MSD) samples were collected at the rate of 1 per 20 samples collected. A total of nine (six from Round 1 and three from Round 2) MS/MSD samples were collected and analyzed for the same parameters as required for the groundwater samples. The MS/MSD samples were collected from the following monitoring wells: MW-15, MW-27, MW-28B, MW-43, MW-47C, MW-50C, MW-60B, MW-65, and MW-98A. Due to internal laboratory requirements, the laboratory selected additional groundwater samples and analyzed additional MS/MSD samples.

QA/QC samples were collected during the implementation of the expedited Area 17 Phase 2 RI soil and groundwater investigation. QA/QC samples collected for analysis included trip blanks, field blanks, QA duplicates, blind QC duplicates, and MS/MSDs. Specific details of the QA/QC sampling program for the Area 17 investigation is presented in the area-specific soil and groundwater ROI for Area 17, dated December 1993.

QA/QC samples were collected during the implementation of the SGWS program. QA/QC samples collected included field blanks, trip blanks, blind QC duplicates, QA duplicates and MS/MSD). For additional information on SGWS QA/QC sampling refer to the Work Plan Addendum dated December 1994.

A summary of analytical methods for groundwater sampling is presented in Table 3-10.

3.3.4 Supplemental Hydrogeological Investigation

As part of the Phase 2 RI, WESTON conducted a supplemental hydrogeological investigation to define the physical characteristics of the subsurface environment at the former Arsenal. These characteristics, along with the groundwater quality information from the monitoring well sampling and the SGWS, were used to refine the preliminary conceptual model of the site. The model, in turn, was used to evaluate the groundwater flow system and potential contaminant transport. The supplemental hydrogeological investigation consisted of the following:

- A Stratigraphical Investigation to define the composition and structural characteristics of the subsurface materials.
- A Groundwater Level Monitoring Program to define groundwater flow direction(s) and gradient(s).
- A Tidal Influence Investigation to determine the effects of tidal fluctuations in the Raritan River on the groundwater flow system at the former Arsenal.

Hydraulic conductivity testing, which was proposed in the Phase 2 RI Work Plan as part of the supplemental hydrogeological investigation, was not implemented. The USACE is restricted by DERP program guidelines from performing this type of investigation, specifically the proposed pumping tests, unless the need for groundwater remediation is confirmed.

3.3.4.1 Stratigraphical Investigation

The intent of the stratigraphical investigation was to further define the limits of each stratigraphical unit both vertically and horizontally in order to develop the site-wide conceptual model of geology and hydrogeology. This goal was considered particularly important in areas where groundwater has been contaminated and may require remediation. The stratigraphic investigation included reviewing existing and newly installed Phase 2 RI monitoring well logs to develop a site-wide conceptual model; collecting geotechnical samples from various lithologic units to evaluate their physical properties; and obtaining rock cores during the drilling of bedrock monitoring wells to describe and characterize the nature of the bedrock.

The first step in the stratigraphical investigation was to review regional information, existing groundwater quality data, groundwater elevation data and existing logs of monitoring wells installed during previous investigations to develop a preliminary understanding of site-wide geology and hydrogeology. The Phase 2 RI work plans were based on this initial review. During implementation of the various field efforts, WESTON continuously reviewed data and reevaluated and updated the preliminary conceptual model. This proactive approach allowed for better, more focused data collection, analysis and subsequent reporting of data, and allowed WESTON to modify its technical approach and make adjustments based on field conditions to better meet the objectives of the investigation.

As the Phase 2 RI progressed and bedrock wells were installed, WESTON began preparing preliminary generalized geologic cross sections, fence diagrams and spatial distribution maps, and was able to update the preliminary conceptual model. The updated conceptual model

- Provided on-site geologists with an understanding of site-wide and area-specific geology/hydrogeology in order to focus on specific lithologic units of concern and make informed field decisions.

- Provided the basis for modifications to proposed monitoring well construction including the placement of well screens and the depths of wells yet to be installed.

- Allowed early discussion of hydrogeologic issues with the USACE, USEPA, and NJDEP and was the basis for modifications to implementation of the SOW.

The Phase 2 RI Work Plan proposed a minimum of eight geotechnical soil samples be collected from suspected semiconfining/confining lithologic units encountered during drilling of overburden and bedrock wells. In order to better characterize the lithologic units of concern, a total of 13 geotechnical soil samples were collected during installation of monitoring wells. Most of the geotechnical soil samples obtained during drilling of monitoring wells were collected from the MM unit or Raritan Fire Clay unit. In addition, a total of 67 geotechnical soil samples were collected from shallow soil borings during the area-specific soils investigation. Most of the geotechnical soil samples obtained from soil borings were collected from the US unit and/or LS unit, and several were collected from the MM unit. A summary of the geotechnical soil sampling program is presented in Table 3-11. Geotechnical soil samples were sent to WESTON's Environmental Technology Laboratory and analyzed for geotechnical parameters including particle size, triaxial permeability, Atterberg limits, specific gravity, and moisture content. A discussion of geotechnical soil sampling results is presented in Section 4.2.1.

The Phase 2 RI Work Plans proposed that rock cores be obtained during the drilling of bedrock monitoring wells to characterize bedrock formations. The Work Plans proposed that rock cores would extend a minimum of 5 feet into competent bedrock, and 10 feet of rock coring was assumed at each bedrock monitoring well location. However, based on field conditions (i.e., the variability of the bedrock encountered and the degree of weathering), rock cores extended more than the assumed 10 feet. In an attempt to better characterize the water-bearing zone being monitored and fracture zones, rock cores were extended, in most cases, to the bottom of the open-hole interval in the bedrock monitoring well. Rock cores were used in the field to determine the depth at which competent rock was encountered, to determine the depth at which to set the inner PVC well casing, and to evaluate potential water-bearing zones. A summary of the rock coring program is presented in Table 3-12.

As the rock cores were retrieved, the lithologic and fracture characteristics of each rock core were logged in the field by WESTON geologists. Logging for each rock core included highlighting rock type (igneous, metamorphic or sedimentary), fracture characteristics (such as natural and mechanical fractures, location and amount of fractures), recovery, rock quality designation (RQD), strength and competency. A supplemental quality assurance and quality control evaluation was performed by a WESTON senior geologist experienced in the analysis and evaluation of fractured rock.

The results of the stratigraphical investigation are presented in Section 4.2.

3.3.4.2 Groundwater Level Monitoring Program

A comprehensive, site-wide groundwater level monitoring program was performed as part of the Phase 2 RI supplemental hydrogeological investigation. Information obtained from the site-wide groundwater level monitoring program was used to evaluate the following:

- Horizontal groundwater flow and hydraulic gradients in both the overburden and bedrock water-bearing zones.
- Vertical groundwater flow potentials.
- Interrelationship between groundwater and surface water.

All newly installed data points (i.e., monitoring wells, staff gauges) were surveyed by a New Jersey licensed surveyor to ensure that all data points were based on the same horizontal and vertical datum. In order to verify historical survey data, WESTON requested that the surveying contractor survey the locations and top of casing elevations of several previously installed monitoring wells. Based on a comparison of historical survey data for these monitoring wells and the new survey data, several discrepancies were noted. Therefore, all existing monitoring wells were resurveyed along with the newly installed Phase 2 RI monitoring wells.

In an attempt to expedite the Phase 2 RI groundwater report, only three of the six groundwater level monitoring events initially proposed have been performed. This approach was agreed upon by the USACE, USEPA and NJDEP during a teleconference on 17 November 1994. As agreed, WESTON would review the results of the three groundwater level monitoring events, evaluate the usefulness and completeness of the data, and would recommend performing additional water groundwater level monitoring events, if warranted.

The groundwater level monitoring program included obtaining groundwater level data from 140 existing and newly installed Phase 2 RI monitoring wells. In addition, WESTON installed 17 staff gauges in suspected tidally influenced and upgradient locations to evaluate the relationship between surface water and groundwater. Selected staff gauges and monitoring wells were used during the tidal influence investigation. It should be noted that the Phase 2 RI work plan proposed 14 staff gauges at specific locations. However, based on a revised understanding of site hydrology, salinity data and observations of surface water bodies through the site, 17 staff gauges were installed at locations better suited to the goals of the Phase 2 RI. Although the Phase 2 RI work plans proposed that groundwater levels were to be obtained from specific monitoring wells, WESTON obtained groundwater level measurements from 140 existing and newly installed monitoring wells. The decision to incorporate all existing and newly installed monitoring wells into the groundwater level monitoring program was based on a review of the depths and lithologic units penetrated by the monitoring wells. It was apparent that without obtaining groundwater elevations from as many data points as possible, gaps in the data could have occurred.

Groundwater level monitoring was performed on all monitoring wells and staff gauges on 3 November 1994 (Round 1), 19 January 1995 (Round 2) and 16 March 1995 (Round 3). The tidal influence investigation was performed during high tide events using selected monitoring wells and staff gauges during the Round 2 and Round 3 groundwater level monitoring events. Staff gauges not included in the tidal influence investigation were measured during each of the three groundwater level monitoring events. Table 3-13 presents a summary of the three groundwater level monitoring events (Rounds 1, 2, and 3). Monitoring well and staff gauge locations are presented on Figure 1-2.

Water level measurements were obtained manually using a Solinst water level meter, which was lowered into the well until the water surface was encountered. The depth to water was measured from the surface of the water to the surveyed reference point marked on the top of the PVC well casing. All water level probes were decontaminated between measurement locations. Groundwater level measurements in general were obtained from all monitoring wells and staff gauges in less than 4 hours during each of the groundwater level monitoring events.

The results of the groundwater level monitoring program are presented in Section 4.3.

3.3.4.3 Tidal Influence Investigation

In order to evaluate the extent of tidal influence and the potential impact of tidal fluctuations on groundwater levels, hydraulic gradients, groundwater flow direction and the migration of potential groundwater contamination, a tidal influence investigation was performed during the Phase 2 RI. The tidal influence investigation was conducted in conjunction with the groundwater level monitoring program. Under agreement with the USACE, USEPA and the NJDEP (17 November 1994), only two of the four proposed tidal influence monitoring events were performed, in an attempt to expedite the completion of the Phase 2 RI. The two tidal influence monitoring events coincide with the Round 2 and Round 3 groundwater level monitoring events of 19 January, and 16 March 1995. Both of these events were in phase with the high tidal periods of the respective months.

Prior to the aforementioned monitoring events, a single location was chosen where both a staff gauge and a monitoring well were monitored continuously over a 24-hour period. The monitoring well chosen for this background monitoring was MW-93A, and staff gauge SG-7. This exercise was used to establish a benchmark of tidal fluctuation in this area, so that proposed tidal monitoring locations could be revised as appropriate.

Although the Phase 2 RI work plans proposed specific monitoring wells and staff gauges to be monitored during the tidal influence investigation, WESTON revised monitoring locations, based on, but not limited to, the following site-specific criteria:

- The pre-test performed on monitoring well MW-93A and staff gauge SG-7.
- Groundwater level elevations obtained during the Round 1 groundwater level monitoring event.
- Proximity of monitoring wells to a water body assumed to be tidally influenced.
- Coupling between monitoring well and staff gauge locations.
- Salinity measurements obtained during monitoring well purging and the surface water/sediment investigation.

An effort was made to collect data from staff gauges that were located in the vicinity of the monitoring wells being used for the survey. The Raritan River controls any possible tidal influence at the former Arsenal. Therefore, at least one staff gauge located in the river was incorporated into the survey during each round of monitoring.

During the mobilization for each round of tidal monitoring, In-Situ, Inc. (PTX-161D and PXD-260) pressure transducers were placed within the well casings and attached to staff gauges and secured to ensure that no vertical motion was possible. Pressure transducers were placed approximately 10 feet beneath the water surface in all monitoring wells, unless the bottom of the well was encountered. In instances where the water column in a well was less than 10 feet, the transducer was placed 1 to 2 feet above the bottom of the well. The staff gauge locations were fitted with a 2-inch-diameter section of perforated PVC piping to surround the pressure transducers. The PVC acted to restrain the pressure transducer from movement in the horizontal direction, as well as shield the transducer from the pressure head associated with the flowing stream. All pressure transducers were situated a few inches above the streambed, so that silt and debris would not interfere with their performance.

All pressure transducers were allowed to acclimate below the water surface for approximately 1 hour prior to initiating the monitoring event. A laptop computer was used to program and activate In-Situ, Inc., Well Sentinel® (LTM-3000®) data loggers. The Hermit (SE-2000®) data logger was programmed and activated via the onscreen display and menu options. During programming of all water level recording devices, a generic reference to Top of Casing (TOC) was given as 100 feet. In general, a sampling frequency of one reading per minute was chosen. A manual water level reading from the TOC or top of staff gauge was taken simultaneous to activation of the well sentinels or Hermit Data logger at each monitoring location. The initial water level measurement coupled with the TOC survey elevation allowed for the groundwater fluctuations to be reported in terms of Mean Sea Level (MSL).

During the tidal influence investigation, rain gauges were used to measure rainfall and evaluate the possible impact of precipitation on groundwater levels. One rain gauge was placed adjacent to monitoring well cluster MW-79, and a second rain gauge was placed adjacent to monitoring well cluster MW-76. The rain gauges were inspected every morning and periodically, after rainfall events. A barometric pressure transducer was placed adjacent to monitoring well cluster MW-79 in order to monitor the potential effects of barometric pressure on groundwater levels. In addition, rainfall and barometric pressure data from a nearby Rutgers University weather station in New Brunswick, New Jersey were obtained.

The Round 1 tidal influence investigation was performed on 19 January 1995, and coincided with the Round 2 groundwater level monitoring event. The Round 1 tidal influence investigation included connecting 1 pressure transducer to each of 18 monitoring wells and 12 staff gauges located in areas of suspected tidal influence and areas of assumed static conditions. One additional pressure transducer was used to measure barometric pressure at a location central to the former Arsenal. Due to the failure of one pressure transducer, staff gauge location SG-7 was eliminated. A total of 26 In-Situ, Inc. Well Sentinels® and one In-Situ Hermit® (SE-2000®) data logger were used to record the water level measurements at a frequency of one per minute over the length of the monitoring event. Each Well Sentinel (LTM-3000) data logger records the water level from one pressure transducer. The Hermit (SE-2000) data logger has the ability to record data from eight transducers simultaneously. For the purposes of this study, four of the inputs were used to gather water level information, and a fifth was connected to the barometric pressure probe.

The Round 2 tidal influence investigation was performed on 16 March 1995 and coincided with the Round 3 groundwater level monitoring event. The Round 2 tidal influence investigation included connecting 1 pressure transducer to each of 19 monitoring wells and 12 staff gauge locations. Two new locations (MW-91A and SG-6) were chosen during the interim period between tidal influence monitoring events, because of the static water level at SG-7 noted during the pre-test and insufficient water level at SG-1. Similar to round one, barometric pressure was recorded using the Hermit (SE-2000®). The Hermit was programmed to record data at a frequency of once every 2 minutes, because of the need to monitor a longer time period.

Following each round of monitoring, the water level information was converted to MSL and plotted versus time. The results of the tidal influence investigation are presented in Section 4.5. A summary of the Round 1 and Round 2 tidal influence investigation is presented in Table 3-14. Monitoring well and staff gauge locations are presented on Figure 1-2.

3.3.5 Deviations From the Work Plan

During implementation of each of the Phase 2 RI groundwater investigation tasks, deviations from the work plan occurred due to modifications to the work plans authorized by USACE. Conditions encountered in the field and an updated understanding of site-wide geology and hydrogeology also caused deviations from the work plan. These deviations are discussed below.

3.3.5.1 Monitoring Well Construction And Development

Deviations from the work plan relating to monitoring well construction and development were as follows:

- The Phase 2 RI Work Plans proposed that 71 additional monitoring wells (including three monitoring/pumping wells) and 12 observation wells were to be installed during the RI. However, during implementation of the work plans a total of 68 monitoring wells (including two monitoring/pumping wells) and five observation wells were drilled. Therefore, a total of 73 monitoring wells were installed during the phase 2 RI.

  The difference between the number of proposed wells and the number of wells actually installed during implementation of the work plans included: a) four proposed wells PW-4, PW-16A, PW-22A, and PW-27B which were not installed; b) four proposed wells PW-23A/B (Area 12) and PW-9A/C (Area 18C) which have not been installed but are planned to be drilled during future field efforts at these AOCs; c) seven proposed observation wells (proposed well I.D.s not assigned) which were not installed; d) five monitoring wells (not proposed) MW-81A, MW-83A, MW-84A, MW-85A and MW-97B which were added to the proposed monitoring well net work. Therefore, a total of 11 wells (4 monitoring wells and 7 observation wells) have been deleted from the Phase 2 RI and five monitoring wells were added.

  Proposed monitoring well PW-4 planned for installation at Area 17 (just north of Area 10), was deleted from the investigation due to its proximity to existing monitoring wells MW-55A and MW-55B. This deviation from the work plan was further explained in the Area 17 ROI dated December 1993.

  Proposed monitoring well PW-16A was planned to be part of a well cluster designed to monitor the US, LS and bedrock aquifer within Area 8 (based on a preliminary understanding of Arsenal-wide geology). Proposed well PW-16A was planned to monitor the US aquifer and was to be constructed as a pumping well for use during proposed hydraulic conductivity testing of the US aquifer. However, during drilling of monitoring wells MW-79B (PW-16B) and MW-79 (PW-16C) the US aquifer was reported to be very thin (less than 5 feet thick) and was not suitable for hydraulic conductivity testing. Furthermore, the results of the stratigraphic investigation indicated that the US water-bearing zones were discontinuous, perched and limited in saturated thickness. Therefore, PW-16A was not installed. It should be noted that observation well OB-05A was installed in the US unit to monitor groundwater levels in the US during proposed hydraulic conductivity testing of the LS and bedrock aquifers.

Proposed monitoring well PW-22A was intended to monitor the US aquifer in Area 16 (based on a previous understanding of Arsenal-wide hydrogeology); however, the US aquifer was not encountered during drilling at this location, therefore, only monitoring well MW-92B (PW-22B) was installed to monitor the LS aquifer.

Proposed monitoring well PW-27B was to be part of a well cluster designed to monitor groundwater in the US, LS and bedrock aquifers in Area 6 (based on a preliminary understanding of Arsenal-wide hydrogeology). However, there was insufficient saturated thickness in the US unit at this location, therefore, only two of the three monitoring wells (MW-96A and MW-96C) in the proposed well cluster were drilled.

Five monitoring wells were added to the Phase 2 RI investigation. Monitoring wells MW-81A, MW-83A, MW-84A, and MW-85A were added to the investigation as replacement wells for MW-SA2, MW-35, MW-36, and MW-37 respectively. Monitoring well MW-97B was added in order to create a well cluster to monitor the entire saturated thickness of the LS in Area 6. Monitoring well MW-97B was installed at the base of the LS unit.

A discussion of modifications to the proposed hydraulic testing including the deletion of seven of the 12 proposed observation wells is discussed in section 3.3.5.6.

- Actual monitoring well locations (as opposed to proposed locations) were moved during implementation of the Phase 2 RI because of underground utilities, aboveground utilities, buildings, parking lots, roadways, access problems (such as wetlands, streams, and wooded areas) or because existing wells were mislocated on site maps. Monitoring well locations were also adjusted at the request of property owners and based on the results of the SGWS investigation.

Based on these criteria a total of 34 monitoring wells (MW-6C, MW-47C, MW-60B/C, MW-63A, MW-71C, MW-76A/B/C, MW-78A, MW-79B/C, MW-87A/C, MW-88A/C, MW-90A/B/C, MW-91A/B, MW-96A/C, MW-97A/B, MW-98A/B, MW-99A/B, MW-101A, MW-103A/C, and MW-104A/C) were moved during implementation of the Phase

2 RI. With the exception of monitoring well MW-78A, which was moved approximately 1000 feet to the northwest because of a change in the location of the AOC (For an explanation refer to the Area 14 ROI), monitoring well locations were not moved to locations which may have altered the proposed purpose of the well or significantly effect the results of the investigation.

- The Phase 2 RI work plans proposed that monitoring wells would be installed to monitor specific hydrologic zones based on a preliminary understanding of Arsenal-wide hydrogeology (i.e., US unit, LS unit, or bedrock) generated as a result of the Phase 1 RI. Based on conditions encountered during drilling, many of the wells proposed to monitor the US unit were not installed in the US unit because groundwater was either not encountered or the saturated thickness was to thin to install a well. Of the 73 monitoring wells installed, 15 wells were proposed to specifically monitor the US unit, 38 were proposed to monitor first water in the LS unit, and 20 were installed to monitor the bedrock aquifer. However, based on field conditions, only four of the proposed US wells (MW-63A, MW-76A, MW-100A and OB-05A) were installed as proposed in the Work Plan. The remaining 11 wells were installed to monitor the first groundwater encountered. At locations that were proposed as well clusters, where the proposed US ("A") well was not installed, the "A" well was installed to monitor first water in the LS unit and the proposed LS ("B") well was installed at the base of the LS unit. If possible, both the A and B well were constructed so that the well screens would monitor the entire LS unit.

- The Phase 2 RI work plans proposed that 10-foot well screens would be installed in overburden wells with a maximum of 15 feet to be used if an entire saturated zone could be monitored. Ten feet of screen was used in wells MW-75A, MW-86A, and MW-99B as opposed to the 15 ft of screen proposed. A total of nine overburden wells (MW-69A, MW-74B, MW-76A, MW-89A, MW-90A, MW-100A, MW-103A, MW-104A, and OB-05A) were installed with screens less then 10 feet long, and 11 overburden wells (MW-28B, MW-50B, MW-60B, MW-72A, MW-91B, MW-93B, MW-96A, MW-97A, MW-97B, MW-98A, and MW-98B) were installed with well screens greater than 10 feet long. In cases where less than 10 feet of screen was used, the well screens were either set above a clay (MM unit or Raritan fire clay) with the top of the screen below the water table and the saturated thickness less than 10 feet, or the well was part of a well cluster in which both the "A" and "B" wells screened the entire saturated zone of the LS aquifer. Fifteen feet of well screen were used if a well cluster or a single well could monitor most or all of the entire saturated thickness of the LS aquifer.

- The Phase 2 RI Work Plans proposed that bedrock monitoring wells would be double-cased if a potential confining unit was encountered (i.e., Raritan Fire Clay). During implementation of the Work Plans, 8-inch outer casing was set into the Raritan Fire Clay at 10 of the 20 bedrock monitoring wells. Three bedrock monitoring wells (MW-49C, MW-60C and MW-96C) did not have double-casing set into the Raritan Fire Clay because it was not encountered. Seven bedrock monitoring wells (MW-50C, MW-71C, MW-74C, MW-75C, MW-76C, MW-79C, and MW-86C) did not have 8-inch outer casing set into the Raritan Fire Clay, when the criteria called for double casing because of decisions made in the field. This deviation is not expected to impact the results of the RI or compromise the integrity of the bedrock monitoring wells for the following reasons: a) 4 inch PVC inner casing was grouted approximately ten feet into competent rock in accordance with the NJDEP Monitor Well Specifications for Bedrock Aquifers, revised March 1993 effectively sealing off the overburden from the open hole water-bearing interval; b) indications of possible contamination such as elevated PID readings, sheen, product, or discernable odors were not noted during drilling; c) after the open hole interval was drilled all drilling fluids were pumped out of the well until the water was relatively clear; d) the bedrock wells were developed for approximately 4-hours or more, and in most cases several hundred gallons of groundwater were purged from the well; and e) groundwater contamination, although detected in the overburden aquifer, was in general, not detected in the bedrock aquifer.

- During monitoring well development, four overburden monitoring wells (MW-69A, MW-76A, MW-89A, and MW-95A) were developed using bailers because it was determined that these wells had very low yields. These four wells were bailed dry and allowed to recover over several days or weeks in an attempt to meet the development criteria.

One or more of the development criteria (discussed in Section 3.3.2) was not achieved for 15 of the 73 phase 2 RI monitoring wells: (MW-69A, MW-71C, MW-75A, MW-75C, MW-76A, MW-76C, MW-88C, MW-89A, MW-90C, MW-91A, MW-95A, MW-96C, MW-99B, MW-104C, and OB-05A. Of these 15 wells, only one well (MW-90C) had less than five well volumes purged during development. Because the estimated well yield was determined to be less then 0.2 GPM, the well was pumped dry several times and took up to three days to fully recover. Six of the 15 wells (MW-71C, MW-75A, MW-75C, MW-76C, MW-90C, and OB-05A) were pumped for less than the 4-hours specified in the work plan. This deviation is not expected to impact the RI since all other development criteria were achieved for each of these wells, with the exception of MW-90C.

Six of the 15 wells (including the four wells which were bailed and MW-90C and MW-104C) did not meet the 50 NTU criteria for turbidity because they were screened in silty zones and/or had very low yield wells with very slow recharges and could not be pumped at a sufficient rate to remove all fine-grained materials. Seven of the 15 wells (MW-88C, MW-89A, MW-90C, MW-91A, MW-95A, MW-96C, and MW-99B) did not meet the development criteria for water quality parameter (pH, specific conductivity, and temperature) stabilization. Four of these wells (MW-88C, MW-91A, MW-96C, and

MW-99B) meet all the other development criteria. The remaining three wells did not meet one or more of the development criteria discussed above.

3.3.5.2 Groundwater Sampling Program

Deviations from the work plan relating to the Round 1 and Round 2 groundwater sampling program are as follows:

- The Work Plans proposed sampling MW-49 twice (once for Area 10 and once for Area 19). Since groundwater samples were collected concurrently for all expedited and non-expedited sites (except Area 17), double sampling at MW-49 was not necessary as proposed. The parameters proposed for the Area 19 sample included TAL metals, with all other parameters the same as the proposed Area 10 sample.

- During implementation of the work plan a total of 119 monitoring wells were actually sampled. This discrepancy is due to the following: a) four wells (MW-SA2, MW-35, MW-36, and MW-36) were deleted and five wells MW-81A, MW-83A, MW-84A,, MW-85A and MW-97B were added to the groundwater sampling Program (see section 3.3.5.1); b) nine monitoring wells associated with Areas 18B through 18G were not sampled because the soil and groundwater investigations in these AOCs were not performed pending approval of the Work Plan Addendum; c) six monitoring wells associated with the groundwater investigation of Area 17 had been previously sampled twice in accordance with the work plan dated December 1993; and d) eight proposed (PW-4, PW-16A, PW-22A, PW-23B, PW-27A, PW-41A and PW-42A) wells were not installed during the Phase 2 RI.

- The Work Plans proposed sampling a total of 74 monitoring wells during the Round 2 groundwater sampling event. However, during the Round 2 sampling event, a total of 67 monitoring wells were sampled. This discrepancy is due to the following: a) eight monitoring wells were not installed during the Phase 2 RI; b) existing well MW-40 was added to the round 2 sampling event because it was omitted inadvertently from the Work Plans and it was not sampled during the Round 1 sampling event; c) three replacement wells (MW-83A, MW-84A, and MW-85A), and one well (MW-97B) added to the investigation were sampled during the Round 2 sampling event; and d) four wells associated with the Area 17 groundwater investigation were previously sampled twice and not included in the Round 2 sampling event.

- During monitoring well purging, additional water quality parameters (dissolved oxygen, salinity, eH and turbidity) not required in the Work Plans, were measured in order to better define groundwater quality and provide additional information which could be used to evaluate analytical data. Purging continued, at most wells until greater than five well volumes had been purged, and turbidity readings less then 50 NTUs were obtained.

However, it was not always possible to reach 50 NTUs because several wells had low yields or were set in very silty zones.

- The work plan required that 10 percent of the samples be checked for pH to ensure that they were preserved in accordance with the requirements of the CDAP. During the implementation of each sampling event approximately 25 percent of the samples submitted to the laboratory were checked for pH.

- The work plan proposed that 25 percent of the samples would be analyzed for TAL metals. During implementation of the work plan 33 percent of the samples submitted for metals during the Round 1 sampling event and 30 percent during the Round 2 sampling event were analyzed for TAL metals.

3.3.5.3 Quality Assurance/Quality Control Sampling Program

Deviations from the work plan relating to quality assurance and quality control (QA/QC) were as follows:

- The Phase 2 RI Work Plans required that field blanks be collected and analyzed for each analytical parameter proposed in the sampling plans. However, the field blanks were analyzed for TAL metals as opposed to PPM. Since the field blanks were collected at the required frequency and the TAL metal analysis also included PPM, the potential blank contamination of PPM can still be assessed through the existing TAL metal results.

- The Phase 2 RI Work Plans required that the matrix spike and matrix spike duplicate (MS/MSD) analyses be performed for all the analytical parameters at a frequency of one per 20 samples during implementation of the work plans, a total of 127 samples were collected and analyzed for PPM. Therefore, six MS/MSD samples were required, however, only five MS/MSDs were analyzed for PPM. A total of 59 samples were collected and analyzed for TAL metals which required only three MS/MSDs but four were analyzed. Since the analysis of TAL metals also included the PP metal elements, the additional MS/MSD analyzed for TAL metals made up for the missing MS/MSD analysis of PPM.

  In addition to the field designated metal MS/MSD samples, the laboratory performed additional MS/MSD analyses for various metal elements for internal batching purposes.

- The analyses of hardness, total dissolved solid, and oil and grease were not required as per Phase 2 Work Plans but were analyzed by the laboratory due to internal QA requirements.

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3.3.5.4 Groundwater Level Monitoring

- In an effort to expedite the Phase 2 RI, only three of the six groundwater level monitoring events were performed. This deviation was agreed upon between the USACE, NJDEP, and USEPA during a teleconference on 17 November 1994.

- The Phase 2 RI Work Plans proposed that water levels would be obtained from 118 monitoring wells and 14 staff gauges. However, in order to better characterize the hydrogeology at the former Arsenal, ground water level measurements were collected from 140 monitoring wells and 17 staff gauges during each of the water level monitoring events.

- Three additional staff gauges were installed to better characterize each of the drainage areas identified during the surface water/sediment investigation. The locations of the proposed staff gauges were also modified based on field observations and salinity measurements, to better meet the goals of the groundwater level monitoring program and define the interaction between surface water and groundwater. Specific details relating to modifications to proposed staff gauge locations are discussed in Section 3.3.5.5.

3.3.5.5 Tidal Influence Investigation

- In an effort to expedite the Phase 2 RI only two of the four tidal influence investigations were performed. This deviation from the work plan was agreed upon by the USACE, NJDEP, and USEPA during a teleconference on 17 November 1994.

- The Phase 2 RI work plans proposed monitoring 11 staff gauges SG-1 through SG-11), eight existing monitoring wells (MW-19, MW-25, MW-44, MW-48B, MW-51, MW-53, MW-60, and MW-65) and nine proposed monitoring wells (MW-68A, MW-80A, MW-90A, MW-91A, MW-92A, MW-93A, MW-98A, MW-100A, and MW-101A) during the tidal influence investigation. During the tidal influence investigation, all of the staff gauges and 11 of the 17 monitoring wells were to be monitored manually every 60 minutes. The remaining six monitoring wells were to be monitored continuously using data loggers. However, during the implementation of the tidal influence investigation all staff gauges and monitoring wells included in the monitoring event were monitored continuously using data loggers.

- A total of 14 staff gauges were proposed in the Phase 2 RI Work Plans, however, three additional staff gauges (SG-15, SG-16, and SG-17) were installed at the northern edge of the site in order to evaluate the northern extent of tidal influence. Ten of the 14 proposed staff gauges were relocated prior to implementation of the groundwater level monitoring or tidal influence investigations. Two of staff gauges SG-1 and SG-2 were relocated because of access problems along the Raritan River and health and safety concerns. Six of the ten staff gauges (SG-4, SG-5, SG-7, SG-8, SG-9, and SG-13) were moved closer to monitoring well locations to better meet the objectives of the investigation and to assist in characterizing the relationship between surface water and groundwater. The proposed locations of staff gauge SG-6 and SG-8 were switched and SG-6 was moved near the floodgate at the south end of Red Root creek to monitor the tidal fluctuation at this location. Staff gauge SG-13 was moved to Area 16 adjacent to monitoring well MW-90A in order to better characterize the relationship between surface water and groundwater. Staff gauge SG-12 was moved to the proposed location of SG-13 and was not replaced with another staff gauge.

During implementation of the Round 1 tidal influence event, 12 staff gauges and 18 monitoring wells were used to monitor water levels because: a) staff gauges SG-3, SG-6, and SG-7 were eliminated and staff gauges SG-13, SG-15, SG-16, and SG-17 were added; and b) monitoring wells MW-19, MW-25, MW-44, MW-48B, MW-51, MW-53, MW-65, MW-68, MW-91A, MW-92A, MW-98A, MW-100A, and MW-101A were eliminated and replaced with MW-50, MW-50C, MW-60C, MW-61, MW-76B, MW-76C, MW-77A, MW-79B, MW-79C, OB-05A, MW-94A, MW-96A, MW-96C, and MW-99A. Although staff gauge SG-7 was not used during either of the tidal monitoring events a pre-test was performed at this location and it was determined that there was no tidal fluctuation at this location.

During the Round 2 tidal influence monitoring event 12 staff gauges and 19 monitoring wells were used to monitor water levels because: a) staff gauges SG-1, SG-3, and SG-7 were eliminated and staff gauges SG-13, SG-15, SG-16, and SG-17 were added; and b) monitoring wells MW-19, MW-25, MW-44, MW-48B, MW-51, MW-53, MW-65, MW-68, MW-92A, MW-98A, MW-100A, and MW-101A were eliminated and replaced with MW-50, MW-50C, MW-60C, MW-61, MW-76B, MW-76C, MW-77A, MW-79B, MW-79C, OB-05A, MW-91A, MW-94A, MW-96A, MW-96C, and MW-99A. Many of the monitoring wells proposed to be included in the tidal investigation were eliminated because they were screened in more then one hydrologic unit, they were not paired with a well cluster, or were not located close enough to staff gauges.

The changes to the tidal influence investigation discussed above were based on the results of the surface water/sediment investigation and a revised understanding of arsenal-wide hydrogeology.

- The proposed pre-tidal investigation monitoring on MW-68A was not performed to evaluate natural fluctuations due to rainfall and was not monitored 24-hours prior to the test. However, a pre-test was performed on monitoring well MW-93A, and staff gauge SG-7 prior to the Round 1 tidal influence event. In addition, a barometric pressure probe and rain gauges were used during each event to evaluate effects of changes in barometric pressure and rainfall during the investigation. These data were supplemented with data from the Rutgers University weather station.

3.3.5.6 Hydraulic Conductivity Testing

Hydraulic conductivity testing was proposed as part of the Phase 2 RI. The number of proposed pumping tests related to the number of distinct water-bearing units, which may require remediation during the future. These suspected water-bearing units (US, LS, and bedrock) were identified during the preliminary review of existing geologic and hydrologic data generated by the Phase 1 RI. Specifically, three separate 24-hour pumping tests were proposed.

The first pumping test was designed to stress and evaluate the US aquifer and to monitor underlying aquifers and suspected semi-confining/confining layers. This test was to be accomplished by pumping proposed US monitoring well (PW-16A), while monitoring proposed LS monitoring well PW-16B, proposed bedrock monitoring well PW-16C, and four proposed observation wells screened within the US.

The second pumping test was designed to stress and evaluate the LS aquifer and to monitor the overlying US and underlying LS aquifers and suspected semi-confining/confining layers. This test was to be accomplished by pumping proposed LS monitoring well (PW-16B), while monitoring proposed upper sand monitoring well PW-16A, proposed bedrock monitoring well PW-16C, and four proposed observation wells screened within the LS.

The third pumping test was designed to stress and evaluate the bedrock aquifer and to monitor the overlying US/LS aquifers and suspected semi-confining/confining layers. This test was to be accomplished by pumping proposed bedrock monitoring well (PW-16C), while monitoring proposed US monitoring well PW-16A, and proposed LS monitoring well PW-16B, and four proposed observation wells screened within the bedrock aquifer.

Based on the results of the Phase 2 RI stratigraphical investigation as well as an interpretation of subsurface conditions observed during drilling for each of the Phase 2 RI field efforts, WESTON recommended that the hydraulic conductivity testing proposed in Section 5.21.5 of the Phase 2 RI work plan be modified. Therefore, proposed (pumping well) monitoring well PW-79A and seven proposed observation wells were not installed. However, proposed (pumping wells) monitoring wells PW-16B ad PW-16C (MW-79B and MW-79C) were installed as planned. In addition, one observation well was installed within a thin discontinuous US unit and four LS observation wells were installed adjacent to the pumping wells (see Section 3.3.2.2 and the area-specific soil ROI for Area 8 for a description of monitoring well and observation well construction specifications and development procedures). The NED postponed aquifer testing at the site, as DERP guidelines require that such testing occur only to support remediation design efforts.

3.4 SURROUNDING WELL USE SURVEY

As part of an initial evaluation of wells within and surrounding the former Arsenal, WESTON performed a surrounding well use survey. The purpose of the survey was to

- Identify potable and/or production wells that potentially could utilize groundwater from the site or that could influence natural groundwater flow at the site.
- Identify sites possibly involved in past or current RIs or cleanups that may impact the Phase 2 RI.
- Review available well logs to evaluate geologic conditions at the site and the surrounding area and to evaluate the possible use of existing monitoring wells for the Phase 2 RI.

The surrounding well use survey included a review of only those well records obtained from an NJDEP file search and is included in Appendix C.

3.5 PRELIMINARY EVALUATION OF POTENTIAL NON-DOD SOURCES OF CONTAMINATION

As part of the Phase 2 RI, the USACE authorized WESTON to perform a preliminary evaluation of potential Non-DOD sources of contamination. A limited surrounding land use survey was conducted and 15 industrial facilities within or adjacent to the former Arsenal were identified which could potentially impact soil and groundwater quality at the former Arsenal. A limited file search of these facilities was conducted to identify data related to past or current RIs or site cleanups which could potentially affect the former Arsenal. The results of this file search were submitted in a letter report to the USACE KCD, dated 24 August 1993. The report is presented in Appendix D and presents a summary of WESTON's evaluation based on a review of available site records obtained from the NJDEPE, USEPA, and local health departments, a summary of regulatory contacts utilized for the file search, and a figure that identifies the location of each of the 15 facilities evaluated.

Additionally, WESTON was tasked to identify available data related to past or current RIs or cleanups that could potentially impact the former Arsenal. To accomplish this task WESTON reviewed the NJDEPs SRP Report "Known Contaminated Sites in New Jersey", 1994, the NJDEPE Bureau of Underground Storage Tanks "Alpha Listing" of Registered Underground Storage Tanks for Middlesex County, printed on 28 October 1994 and USEPA "CERCLIS" List for Region II, printed October 11, 1994. Based on this review, numerous sites were identified within and adjacent to the former Arsenal which may be impacting soil and groundwater quality. Information regarding known contaminated sites, registered underground storage tanks and CERCLIS list sites are discussed in Section 6.7.

The purpose of this preliminary evaluation of potential Non-DOD sources was to identify potential sources of contamination which are not attributable to Army activities at the former Arsenal. This preliminary evaluation was not intended to identify potentially responsible parties, but was intended to identify properties with industrial processes or waste disposal practices within the boundaries of or adjacent to the former Arsenal which indicate the potential for soil and groundwater contamination. The analytical results of samples collected at several of these facilities, as well as the results of the Phase 1 and Phase 2 RI were evaluated to determine if potential off-site sources of contamination have impacted the former Arsenal. A discussion of potential Non-DOD sources of contamination is presented in Section 6.7.

SECTION 4.0

RESULTS OF SUPPLEMENTAL HYDROGEOLOGIC INVESTIGATION

The Phase 2 RI was designed to further evaluate and clarify the geologic, hydrogeologic and geomorphic attributes of the former Arsenal and how they affect contaminant fate and transport. The following sections present the results of the supplemental hydrogeology investigation performed as part of the Phase 2 RI. The results of this investigation are based on:

- The stratigraphical investigation which included: a review of boring logs for existing and newly installed monitoring wells, the results of geotechnical analyses for soil samples and the results of rock coring performed during the installation of 20 bedrock monitoring wells.
- Three water level monitoring events including 140 monitoring wells and 17 staff gauges.
- Two tidal influence monitoring events.
- Field observations and measurements obtained during drilling activities, monitoring well development and monitoring well purging during groundwater sampling.

The following sections discuss Arsenal-wide topography, geology, hydrogeology, surface water hydrology, tidal influences and provides the basis for contaminant fate and transport discussions in Section 5.0.

4.1 ARSENAL-WIDE TOPOGRAPHY

Figure 4-1 illustrates the dominant topographical features of the former Arsenal. The former Arsenal is located in the northernmost portion of the Atlantic Coastal Plain Physiographic Province of New Jersey, near its convergence with the Piedmont Physiographic Province. Consequently, the topography is quite flat to gently sloping. Elevations for the study area range from approximately 100 feet above Mean Sea Level (MSL) (National Geodetic Vertical Datum of 1929) in the northwestern portion of the site (MW-74B/C at Middlesex County College), to approximately 4 feet above MSL along the southern boundary of the site (near MW-28B and the banks of the Raritan River). The general slope of the topography is from the northwest to the south-southeast.

The north-central portion of the study area exhibits a sharp drop in elevation from approximately 100 feet above MSL to approximately 50 feet above MSL. Historical sand and clay mining activities referred to in the Archival Search Report (Dames and Moore, July 1993), past cut and fill activities and recent development (i.e., Raritan Center business park) by present property owners have all contributed to reshaping the topography to its present form. The descent from the northern portion to the southern portion of the former Arsenal is not gradual in all areas (Figure 4-1). Traversing from the northern portion to the central portion of the site, the surface gradient ranges from 0.011 feet/feet to 0.034 feet/feet with an average gradient of 0.019 feet/feet.

From the central portion of the site the land slopes gradually to the banks of the river and adjacent estuary. The average surface gradient for this region of the site was calculated to be 0.004 feet/feet.

In the southern portion of the former Arsenal, the land consists of tidal marshlands, streams, and man-made features (i.e., roads, railways, dikes, etc.) that were constructed during the early development of the Arsenal. Most of these DOD-related features were built on fill material imported from other portions of the site. During development of Raritan Center by the current property owners, large volumes of native soils were moved and deposited in the southern portion of the site, but in general, the topography has remained relatively flat.

4.2 ARSENAL-WIDE GEOLOGY

The region containing the site is characterized by Triassic and Jurassic Rocks of the Passaic and Palisades Formations, overlain by unconsolidated sediments (cyclic beds of clays, silts, sands and gravels) that are Cretaceous in age. To assist in characterizing the Arsenal-wide geology, a conceptual model was developed based on the stratigraphical investigation. The current model has subdivided and consolidated the overburden and bedrock geology at the former Arsenal into six distinct stratigraphic units. There are two bedrock and four overburden stratigraphic units. From oldest to most recent, the stratigraphic units are:

- Passaic Formation (PAS) - Triassic age rock, which consists of red, red-brown and gray interbedded shales, siltstones, mudstones, conglomerates and some slightly metamorphosed rocks. This formation is characterized by numerous fractures, easily-weathered zones and layers of interbedded siltstone, shales and sandstones.

- Palisades Sill (PAL) - Late Triassic age rock, which consists of gray to dark gray igneous diabase intrusive material. The PAL has, in some cases, affected locally adjacent shale beds and metamorphosed the shale to a slate material (Barnsdale, 1943). The PAL is found at depth in the southern portions of the Arsenal and could be a potential boundary unit (geologic and hydrologic).

- The Weathered Bedrock Group (WBK) - This grouping consists of the Raritan Fire Clay (lower Cretaceous) and the weathered Passaic and saprolite units. These units were consolidated into one group because the areal distribution and properties of each are similar.

The Raritan Fire Clay is described as a fat clay, and ranges in color from blue, brown, gray to red. The clay is not present in the southwestern portion of the Arsenal (near MW-49C), as well as in the region near the PAL Formation. The weathered Passaic unit is highly decomposed red-brown, red and gray siltstone, mudstone, shales and conglomerates. The weathered Passaic unit is usually highly fractured and friable. This unit is consistent across the Arsenal in areal extent except in the southwestern portions of the Arsenal (near monitoring wells MW-49C, MW-55B, MW-60C and MW-96C).

- Lower Sand (LS) - This formation is believed to be the remains of the Farrington Sand and includes some clayey and silty interbeds. These clayey and silty units may act as localized leaky-confining or semi-confining units. Overall, the LS is a coarse, medium to fine-grained sand, with some gravel and finer-grained material. The color varies based on some localized iron staining, but is usually brown, yellow-brown or red brown.

- Meadowmat (MM) - This formation (formerly called Peat in the work plan) is an organic-rich, black or brown clayey or silty material with some interbedded sands. This material consists primarily of silt and clay which has gradational contacts with abundant organic matter (ranging up to 90 percent). Overall, the unit has a thickness that ranges from zero feet (in the north-central portions of the former Arsenal) to approximately 10 feet. In some areas of the site (primarily at the southern end of the site), it appeared that natural vegetation was interbedded (in a "layer cake" fashion) with suspected dredge spoils. In certain cases this material was logged as MM, and in others it was logged as US (i.e., fill, or relocated natural sediments).

- Upper Sand (US) - This formation includes fill material, including dredge spoils, construction debris and reworked natural material.

The heterogenous nature of the soil and rock formations at the site, required that similar groups of soils and rock be consolidated in order to present the data in a clear and concise manner. In certain situations, clay and silt material were consolidated into the classification of LS, even though the material is not sand-like. The clay and silt were grouped together and classified as LS because they have been determined to be local units of limited areal extent (within the LS unit) and, from an Arsenal-wide perspective, are not considered to be significant. The Weathered Bedrock Group is a combination of the Raritan Fire Clay unit and weathered bedrock unit of the PAS Formation. The US is a grouping of fill material, reworked native soils, and dredge spoils.

4.2.1 Overburden Geology

The following subsections present a detailed discussion of the nature and distribution of each of the stratigraphical units encountered at the former Arsenal. These descriptions include visual observations, predominant lithologies, and results of the geotechnical analyses. Many of the specific physical parameters (i.e., specific gravity, grain size analyses, Atterberg limits) were obtained through the analysis of geotechnical samples collected from intervals within these units. Appendix E contains the laboratory report of results for all of the geotechnical sample analyses. Triaxial permeabilities (reported as hydraulic conductivities) for each of the stratigraphic units are discussed in the subsections related to overburden hydrogeology.

The distribution (i.e., the horizontal and vertical extent of the units) is also discussed in the following subsections and depicted on Figures 4-2 through 4-6. Seven cross-sections were created and evaluated based on the geologic model created and krigged by DGI Earthvision software. The cross-section location lines are shown on Figure 4-7, while the stratigraphic thicknesses and spacial relationship between the geological units are depicted on the seven site cross-sections (Figure 4-8).

4.2.1.1 Upper Sand (US) Unit

The US unit is the uppermost stratigraphical unit encountered at the site. This unit has a maximum thickness of 33 feet at MW-63 (believed to be dredge spoils), but in most cases is relatively thin (i.e., 2 to 10 feet thick). The US unit was encountered in most soil borings and is primarily composed of reworked native soils and fill material (including construction debris); the result of historic cut and fill operations across the former Arsenal. This cut and fill technique was used by the Army to develop areas for use during the more than 60 years of operations at the former Arsenal.

In many cases (primarily in the northern one-third of the study area), the interface between the native soil and the reworked soil was very difficult to distinguish due to the sandy nature of the material. The presence of organic material (i.e., root fragments) or sands stained with iron and manganese precipitate (with iron being the most prevalent), were signs often used to indicate native material.

The US unit is believed to be discontinuous across the southern portion of the site. A large percentage of the southern half of the site was made accessible during the early stages of development of the former Arsenal by constructing roads and railways of fill material (i.e., US). Most of this fill material was borrowed from other areas of the former Arsenal. Once accessible, buildings, impoundments and dikes were constructed. Prior to development of the former Arsenal this region contained floodplain deposits and wetlands vegetation. During the Phase 2 investigation, natural river sediments and related meadowmat material were often observed at the surface in the areas undisturbed by development. The majority of soil borings in the southern portion of the site were installed along roads and other easily accessible areas, and thus encountered US at most locations.

Based on historical documentation, the southern portion of the former Arsenal also contains areas of dredge spoils which were disposed of in trenches and on the ground surface. These "deposits" were classified as part of the US unit in most cases but resemble the native flood plain sediments in this portion of the site. It is believed that between dredging operations, a suitable amount of time passed; permitting wetlands vegetation to grow, only to be buried by subsequent dredge spoil disposal. Therefore, distinguishing between native sediments and relocated sediments was difficult. Based on borings near the Raritan River, some of the dredge spoils in Area 11 have been calculated to be in excess of 30 feet thick. Figure 4-8, cross-section 5-5' depicts a cross-sectional view of a portion of the southern part of the site. The sediments classified as US (dredge spoils) are obviously much thicker near MW-28B and MW-63 (and near the river in general), exemplifying the differences observed between the northern and southern parts of the site.

A total of 42 geotechnical soil samples (stainless steel inserts and Shelby tubes) were collected from the US unit at the former Arsenal. Table 4-1 contains the results of the geotechnical analyses. Based on the grain size analysis for the samples collected from the US unit, the USCS classification was predominantly silty sand (SM). Ten of the 42 samples were classified as low to high plasticity silts (ML or MH) or low plasticity clay (CL). The Atterberg limits, which include the liquid limit, the plastic limit and the plasticity index are also included on Table 4-1. The specific gravity results ranged from 2.42 to 2.79.

4.2.1.2 Meadowmat (MM) Unit

The MM unit is an organic-rich, clay and silt material (formerly called peat) and is discontinuous across the site. Figure 4-2 illustrates the areal distribution and approximate thicknesses of the MM unit encountered in soil borings. Generally, the MM material is found in the south-southeastern portion of the former Arsenal, although, thin layers were noted as far north as monitoring well cluster locations MW-86 and MW-89. The MM unit was most often observed either underlying the US unit or exposed at the surface. The thickness of the MM unit ranges from zero feet (in the northern portion of the former Arsenal) to approximately 33.5 feet thick at location MW-96A. In general, the MM unit thickens towards the river. This trend is depicted in Figure 4-8, cross-sections 2-2' and 4-4'.

A review of the Archival Search Report (Dames and Moore, July 1993) and communications with present property owners (i.e., Summit Associates and Federal Business Center) indicated that historical activities related to the development of the former Arsenal (i.e., roadways, office buildings, etc.) involved the bulk removal of large volumes of MM. Most of the excavating occurred in the western portions of the study area (near Areas 9, 10, 19) because these sediments were not suitable as a foundation for development.

Characteristics similar to those of the MM unit were often observed in areas believed to contain dredge spoils. If organic material such as root mat was observed along with marine shell fragments and the location was suspected to contain dredge material (i.e., Areas 6, 11 and 12), the stratigraphic designation most often assigned was that for the US (relocated sediments or fill). In certain situations (in particularly, at MW-96A), the samples were evaluated and logged as MM, but most likely were a combination of dredge spoils and natural vegetative growth.

A total of eight geotechnical samples (stainless steel inserts and Shelby tubes) were collected from the MM unit at the former Arsenal (Table 4-1). Based on the grain size analysis of the eight geotechnical samples, the USCS classifications ranged from high plasticity silt (MH) to silty sand (SM). The moisture content for the MM unit ranged from 15.40 to 138.30 percent. The specific gravity for the MM ranged from 2.67 to 2.78.

4.2.1.3 Lower Sand (LS) Unit

The LS unit is believed to be a remnant of the Cretaceous Raritan Formation (Farrington Sand Member) and the Pleistocene Series (Cape May Formation). The LS consists of coarse to fine-grained sands and some gravels, with thin and thick lenses (or layers) of silt and clay. The LS unit ranges in thickness from 1.5 feet at MW-89A to 62 feet at MW-74B and is the only unconsolidated unit present across the entire former Arsenal. Figure 4-3 illustrates the areal distribution and approximate thicknesses for the LS unit across the site.

In the northern portion of the study area the LS unit is present at relatively shallow depths (i.e., less than 10 feet BGS) and directly underlies the US unit. The US unit in these areas is believed to be primarily reworked LS that was redistributed during development of the Arsenal. In general, the LS is thickest at the northern end of the site and accounts for the majority of the sediments at these topographically higher elevations. This observation is confirmed by review of the site-wide geologic cross-sections depicted on Figure 4-8.

The LS unit thins as the topography drops off rapidly in the west-central and central areas of the site (i.e., Areas 1, 4, 9, 10 and 19). These areas may actually have been borrow areas for the development of roads and railways in the southern portion of the site.

From these central areas and southward, the LS is overlain by both the US and the MM units of varying thicknesses. The LS thickens as the topography flattens out from the central portions of the study area towards the Raritan River. Thicknesses range between approximately 15 and 40 feet in this region. Based on Figures 4-3 and 4-8, cross-sections 2-2' and 4-4', the LS in this portion of the site was encountered at greater depths relative to the ground surface. This apparent dip towards the river may be a combination of erosion from the river and removal/compression of the unit in relation to the trenching and disposal of dredge spoils.

The Raritan Fire Clay unit of the Weathered Bedrock Group is the stratigraphic unit that underlies the LS in the northern two-thirds of the former Arsenal. In the southern one-third region, the LS exists directly above the weathered zone (saprolite) of the Palisades Sill Formation. Saprolite is thoroughly decomposed rock, formed in place by chemical weathering of igneous or metamorphic parent rock.

A total of 22 geotechnical samples (stainless steel inserts and Shelby tubes) were collected from the LS unit at the former Arsenal Results for these analyses are presented on Table 4-1. Based on the grain size analysis, the USCS classification for the samples collected from the LS unit ranged from poorly graded sand (SP) to well graded sand (SW), with the majority of the samples being a silty sand (SM). One of the 22 samples was classified as a high plasticity silt (MH). The specific gravity results for the LS unit ranged from 2.64 to 2.82.

4.2.1.4 Weathered Bedrock Group

The Weathered Bedrock Group consists of the Cretaceous Raritan Fire Clay, the actual weathered zone of the Passaic (PAS) bedrock formation and saprolite units. These units were consolidated into one group because the areal distribution and properties are similar. Figures 4-4 and 4-5 illustrate the distribution of the Raritan Fire Clay/saprolite unit and the closely related weathered Passaic unit, respectively. Figure 4-8, cross-section 6-6' illustrates the similar distribution of these two units on a line trending northeast-southwest. The complete absence of both units at MW-49C is evident here, as is apparently an erosional unconformity of the bedrock with subsequent deposits of LS.

4.2.1.4.1 Raritan Fire Clay/Saprolite Units

The Raritan Fire Clay unit ranges in color from predominantly brick-red to light brown, blue and gray. Commonly called "Raritan potter's clay" this unit is further described as a "fat clay" of good quality. According to Barnsdale, 1943, the basal part of the Raritan Fire Clay has a brick red color identical in shade with the underlying Triassic red shale from which it was derived. The Raritan Fire Clay is a confining unit for the underlying PAS Formation while saprolite deposits are a confining unit for the underlying PAL formation. This is evident from the areal extent (Figure 4-4), average thickness (12.5 feet) and very low permeability values observed (less than 10E-07 cm/sec).

As depicted on Figure 4-4, the Raritan Fire Clay unit is present across nearly the entire former Arsenal, excluding the region where the PAL is present, and a small area in the west-central portion of the site (near MW-49C). Figure 4-8, cross-sections 3-3' and 4-4' illustrate this "pinching out" of the fire clay in the region of MW-49C and the PAL. Based on the soil boring logs that penetrated this unit, the Raritan Fire Clay gradually became stiffer, and more friable with depth, until it graded into the weathered Passaic unit of the underlying PAS Formation. The thickness of the Raritan Fire Clay unit ranged from three feet near MW-89C to nearly 25 feet at MW-75C.

In most cases, the color of the fire clay matched that of the weathered Passaic unit and the PAS Formation. In the northern portions of the site the clay was predominantly red and graded into a weathered, red, siltstone or sandstone. Towards the central and southern two-thirds of the former Arsenal, where much of the PAS has been altered to a gray slate-like material, the fire clay was usually gray or greenish-gray.

A total of seven Shelby tubes were collected within the Raritan Fire Clay unit. The results for the geotechnical analyses are presented in Table 4-1. Based on the grain size analysis, the predominant USCS classification for the samples collected from the Raritan Fire Clay was a high plasticity clay (CH) or silt (MH). One of the analyses indicated a predominance of silty sand. It is believed that this classification was arrived at due to there being a high percentage of weathered PAS material in the sample (i.e., zones of weathered siltstone and sandstone material) and is not representative of the actual Raritan Fire Clay. The specific gravity values ranged from 2.59 to 2.79.

Saprolite consists of soft, clay-rich, thoroughly decomposed rock that has formed in place by chemical weathering of the PAL bedrock formation. These units were consolidated into one group because the properties of each are similar. The saprolite at MW-28B was observed at a depth of 61 to 62 feet bgs, and consists of white to grayish-white hard, stiff, clay-rich decomposed rock and some phenocrysts (crystalline remnants of porphyritic igneous rock). The boring for MW-28B (in Area 11) was terminated within the saprolite material; therefore, the thickness of this unit is unknown. The saprolite was encountered and fully penetrated at monitoring wells MW-60C and MW-96C located in Areas 12 and 6, respectively. This material was generally less than 5 feet thick at these locations.

4.2.1.4.2 Weathered Passaic Unit

The weathered unit of the PAS Formation that was encountered at the former Arsenal was weak, friable and highly fractured siltstone, sandstone or slate. The color of this unit was usually brick-red to purplish-red, when the parent material was a siltstone or sandstone, and gray if the material was altered to the slate.

The weathered Passaic unit was encountered at the northern-most borings (MW-103C, MW-104C and MW-105C) and was present southward at every other location that the PAS was encountered, except for a "pocket" near MW-49C, where no significant weathering was observed. Figure 4-5 illustrates the distribution of the weathered Passaic unit and the thicknesses observed at the bedrock monitoring well locations.

The thicknesses for this weathered zone of bedrock varied tremendously from less than a foot at MW-79C to nearly 36 feet at MW-89C. In general, the PAS was more weathered further away from the PAL diabase. This is evident on Figure 4-8, cross-sections 2-2' and 3-3'. Of the seven monitoring wells (MW-49C, MW-47C, MW-6C, MW-79C, MW-59C, MW76C and MW-75C) located in the central portion of the site (i.e., the altered PAS unit), six were logged as having less than five feet of a weathered zone.

In the southern portion of the former Arsenal, the PAS Formation was intruded by the igneous diabase PAL Formation and therefore does not exist as the first bedrock unit encountered.

4.2.2 Bedrock Geology

Bedrock was encountered at 20 monitoring well boring locations during the Phase 2 RI. These locations were arranged to provide sufficient coverage (i.e., lithologic and groundwater quality data) across the entire former Arsenal.

Based on the rock core samples collected, three distinct bedrock "zones" are present below the site. Figure 4-6 illustrates the approximate distribution and elevations at which these units were encountered.

The PAL Formation is present in the southern quarter of the former Arsenal. This igneous diabase material was observed in core samples collected from MW-60C, MW-96C and MW-50C. Saprolite of the PAL was also observed in several other samples collected from monitoring well borings in this region (e.g., MW-28B, MW-91B, MW-92B, MW-93B and MW-98B). Boring logs indicating where the saprolite was encountered were used to approximate the extent of the PAL Formation.

North of the estimated PAL boundary, and extending to the northern one-third of the former Arsenal (near the approximate area of maximum change in topographic relief), bedrock samples indicated the presence of a metamorphosed, or altered PAS Formation. Most often the material retrieved in the core samples was a gray, slate-like rock, indicative of a meta-shale or meta-siltstone. At location MW-50C, a contact between the intrusive PAL unit and this altered PAS unit was observed near the bottom of the cored interval (approximately 92 feet below MSL).

The northern one-third of the site (including background locations MW-103C, MW-104C and MW-105C) is underlain by the PAS Formation. Bedrock core samples collected from the monitoring well locations in this region of the site indicated a relatively weak siltstone or shale, that was usually red in color.

Figure 4-6 also presents a summary table for the rock core samples collected at bedrock monitoring well locations and Figure 4-8 (all cross-section lines) illustrates the relative depths at which competent bedrock was encountered. Discussions of individual bedrock units are provided below.

4.2.2.1 Passaic Formation

The PAS Formation is generally comprised of a dark red to gray-lavender shale, siltstone and mudstone with 0.5 to 1.5 mm epidote-chlorite nodules deposited in cyclic sequences. Cycles in the PAS Formation range from lacustrine sequences identical to those of the Lockatong

Formation, to entirely red mud flat cycles that culminate in cross-laminated siltstone (Smoot and Olsen, 1985). The formation contains a higher content of sands and pebbles in the vicinity of the study area (Banino et al, 1970). Shales of the PAS Formation typically have low effective primary porosity, but well developed secondary porosity.

Of the 20 bedrock borehole locations, a total of eight locations (MW-71C, MW-74C, MW-87C, MW-88C, MW-89C, MW-103C, MW-104C and MW-105C) were in the unaltered PAS Formation (Figure 4-6). This unaltered bedrock unit (i.e., unaltered by the igneous PAL intrusive material) was primarily observed in the northern one-third of the former Arsenal. Generally, the rock cores from these locations were red-brown shale with some interbedded siltstone, and mudstone.

Due to the high degree of variability with respect to the thickness of the weathered Passaic unit, the depths at which competent bedrock was encountered also varied significantly. In general, the approximate elevations for competent bedrock ranged between 35 feet above MSL at MW-104C to 59 feet below MSL at MW-50C. It is evident on cross-section lines trending northwest-southeast (2-2', 3-3' and 4-4') on Figure 4-8 that the depth to competent bedrock (relative to ground surface) was greater in both the northern and southern portions of the site. Competent bedrock depths were shallower in the central portion of the site near the region of maximum topographic change (i.e., MW-81A, MW-89C and MW-56).

Fractures in the PAS were found to be both horizontal and vertical with some secondary mineralization (predominantly gypsum). The fractures in the northern one-third of the site have been infilled and differ from the southern two-thirds of the former Arsenal. This difference may be due to the tendency of fractures in the clay-rich sedimentary sequences to weather more easily and deposit residual clay minerals in the natural fractures. The diabase and metamorphosed sequences are more resistant to weathering and therefore contain fractures that tend to be more open. This general difference between the rock types is supported by the observations made during the core evaluations (Appendix F). Table F-1 in Appendix F presents a comparison of the fracture characteristics in each bedrock type identified at the site.

A total of 10 locations (MW-6C, MW-47C, MW-49C, MW-50C, MW-59C, MW-75C, MW-76C, MW-79C, MW-86C and MW-90C) in the central and southern portions of the former Arsenal exhibited rock cores indicative of the metamorphosed PAS Formation (Figure 4-6). The amount and grade of metamorphism was directly proportional to the geographic proximity of the igneous intrusive PAL Formation. The closer the boring location was to the diabase intrusion, a higher grade metamorphism of the rock was observed (refer to the logs for MW-90C and MW-50C as compared to MW-47C and MW-86C). This effect, referred to as contact metamorphism, has altered the shale to a low-grade slate, with some altered meta-sandstone and meta-siltstones interbedded within the slate. Vugs, or weathered cavities, were observed in the slate samples from the core samples collected at locations in the altered PAS zone. Both horizontal and vertical fractures (some at high angles) and some secondary mineralization with gypsum, calcite and pyrite were also observed. The fractures of the metamorphosed slate tend to be more open and exhibit fresher fracture surfaces. This contact metamorphism process that has altered the rock from shale to slate, has likewise, increased the competency of the rock, decreasing the amount of infilling from eroded silts and clays.

4.2.2.2 Palisades Sill Formation

Of the 20 bedrock borehole locations at the former Arsenal, only three locations (MW-50C, MW-60C and MW-96C) exhibited cores representative of the PAL diabase formation. Figure 4-6 illustrates the suspected extent of the PAL at the former Arsenal. The northern boundary for this unit was extrapolated based on borehole samples collected from overburden wells in the vicinity of the depicted boundary. Some of the boreholes for deeper overburden monitoring wells (i.e., MW-91B, MW-92B, MW-98B and MW-99B) were terminated at what was assessed as being saprolite of the PAL. At MW-50C, diabase was observed in the bottom portion of the rock core. The majority of the recovered core was the metamorphosed PAS unit, or gray slate.

This diabase is a dense, crystalline, mafic rock, that is free of vugs, and consequently, has no primary porosity. The core samples collected from the PAL diabase had very few fractures, with some minor secondary mineralization. Coring produced excellent recovery and the rock strength was characterized as "good". The PAL unit dips to the northwest, as depicted in Figure 2-3. The elevations that the PAL was encountered ranged between approximately 40 feet below MSL at MW-60C to 92 feet below MSL at MW-50C. The PAL was encountered at approximately 57 feet below MSL at MW-96C, confirming the dip trend since this monitoring well was located between the other two wells and slightly further from the river than MW-60C.

4.2.2.3 Rock Fracture Evaluation and Analysis

The rock fracture analysis involved orienting the cores so that bedding planes were visible and a definitive dip direction could be determined. During the initial fracture description, bedding dip direction was assumed to be north and the orientation of each set of parallel fractures was recorded relative to this dip direction. Since the orientation of bedding planes is relatively consistent within the PAS Formation at the site, the apparent fracture orientations were subsequently corrected to true north using the local bedding plane orientation, which is strike N54°E, with a dip of 5°NW, (Geologic Map of NJ, Johnson, 1950) and rotating the recorded fracture orientations 36 degrees counterclockwise.

The corrected fracture orientation data were plotted on an equal area stereographic projection (Schmidt net). This method of data analysis projects a pole normal (perpendicular in three dimensions) to the fracture plane through the lower half of a hemisphere. The fracture data were analyzed using these stereographic projection techniques in order to identify any fracture trends that may affect groundwater flow and/or contaminant transport.

As presented in Appendix F, the fracture orientation data were grouped by fracture type and by rock type (sedimentary and metamorphic/igneous). Metamorphic and igneous rock cores were grouped together because of the similar fracture characteristics. This resulted in three stereographic projections per rock type (i.e., sedimentary and metamorphic/igneous). A fourth plot that combined open and partially open fractures was generated for each rock type. These two fracture types are considered to be the important water-bearing fractures and appear to be related, as indicated by the similar orientation of the two fracture types.

Figures F-1 through F-8 in Appendix F, present the stereographic projection of the poles, normal to the various fracture types. Figures F-9 and F-10 in Appendix F, present contour diagrams of the density of points on the stereonet. These contour diagrams were generated using the spherical Gaussian method and clearly illustrate the dominant trends of the open and partially open fractures for the sedimentary rocks (Figure F-9) and the metamorphic/igneous rocks (Figure F-10).

There are two dominant fracture trends shown on the contour diagrams. One set of open/partially open fractures is approximately parallel to the bedding planes (low-angle fractures dipping to the northwest) and is reflected by the concentric contour lines near the center of the diagrams. A second set of fractures is characterized by moderate to high-angle fractures dipping to the southeast or northwest. The strike of this fracture set is generally N50° - 70°E. This high-angle fracture set is believed to represent the most effective water-bearing fractures based on the observed characteristics.

4.3 ARSENAL-WIDE HYDROGEOLOGY

The hydrologic characteristics of the former Arsenal are consistent with the regional hydrology of the New Jersey Coastal Plain Province. In general, unconsolidated formations of the Pleistocene and Cretaceous Periods act as one hydrologic unit, consistent with the findings of Zapecza (1984). The bedrock underlying the former Arsenal acts as a separate, confined hydrologic unit.

The main aquifer of interest at the site is the overburden LS aquifer. This hydrologic unit is continuous across the site and believed to be unconnected with the underlying bedrock aquifer, except in the vicinity of MW-49C, where the Raritan Fire Clay unit was absent (Figure 4-4). Although three types of lithology make up the bedrock at the site, the bedrock aquifer is believed to be a single hydrologic unit, generally confined from the overburden LS aquifer.

For the purposes of evaluating the hydrological trends and interpreting the relationship between these trends and the site geology, the former Arsenal was divided into northern and southern hydrologic zones. Figure 4-9 depicts these two zones. The basis for this division was the approximate areal extent of the MM unit and the prominent change in surface topography. This zonation of the site correlates well with the 10-foot groundwater contour line for the LS aquifer, which represents a sharp change from relatively steep horizontal hydraulic gradients in the north, to the gentle gradients in the southern portion of the site.

The following sections present discussions of the overburden and bedrock hydrogeology and include the applicable geotechnical results (i.e., triaxial permeability parameters, Table 4-1). Horizontal and vertical hydraulic gradients were calculated for select well clusters based on the data collected during the three rounds of groundwater and surface water level monitoring. The horizontal gradients for overburden monitoring wells are summarized in Table 4-2, while the summary of vertical gradients for deep versus shallow overburden monitoring wells is presented in Table 4-3. The horizontal gradients for select bedrock monitoring wells are summarized in Table 4-4, and a summary of vertical hydraulic gradients for bedrock versus overburden wells in presented in Table 4-5.

4.3.1 Overburden Hydrogeology

The uppermost aquifer at the former Arsenal is believed to consist of the remnants of the Farrington Sand Member of the Raritan Formation (Barnsdale, 1943). The overburden aquifer consists of three stratigraphic units; the US, MM, and the LS. The occurrence of groundwater in this aquifer is under both unconfined and semi-confined conditions and groundwater flow direction is generally to the south-southeast, towards the Raritan River.

The US and MM units are not continuous across the entire site and therefore, the water table may be found to exist in any one of the three units (i.e., US, MM or LS), and under varying hydraulic conditions. The following subsections discuss each of the stratigraphical units as hydrological units. Only those wells that are screened entirely within a stratigraphical unit (i.e., not more than one unit) are used to evaluate the hydrological properties of that unit. Monitoring wells with screened intervals existing in two or more units are not considered to be representative of any particular unit and therefore any associated data should be considered using discretion.

Staff gauges were used to measure tidal influences at certain surface water locations and have been correlated with the fluctuations observed in the groundwater levels measured in the overburden monitoring wells on site. These influences are discussed in greater detail in Section 4.4.

The data collected during the groundwater level monitoring efforts (Table 3-13) were used to produce contour maps representing the zones of equal groundwater elevations. Figures 4-10, 4-11 and 4-12 illustrate the contours (at 10-foot intervals) and approximate groundwater flow direction(s) for the entire site. In order to depict the gentler gradients and more complex flow patterns in the southern hydrologic zone (Figure 4-9), three additional figures (Figures 4-13, 4-14 and 4-15) were produced using a one-foot contour interval.

In addition to the groundwater contour maps, Figures 4-16 and 4-17 illustrate the distribution of salinity in overburden and bedrock groundwater, based on field measurements obtained during groundwater sampling. The boundary lines depicted on these figures represent an approximate division between fresh and saline groundwater at the site. The estimated boundary lines are based on instantaneous field measurements and do not take into account salinity fluctuations which might occur due to changes in precipitation, seasonal or annual fluctuations in groundwater, tides or sampling variability. The standard used (0.5 ppt) for this division is based on the N.J.A.C.-7:9-6.5 standard for total dissolved solids (TDS). The concentration of TDS is defined as the concentration of minerals in water. The dissolved minerals are classified as inorganic salts, and thus, is related to salinity.

4.3.1.1 Upper Sand Unit

The US water-bearing zones are discontinuous, perched zones of groundwater of limited saturated thickness. These zones primarily exist in the southern one-third of the former Arsenal and are believed to be recharged by precipitation and interaction with surface water bodies. The areal extent of the US water-bearing zones appears to be proportional to the thickness and extent of the underlying MM unit, which is suspected to be acting as a confining, or semi-confining layer immediately beneath the US.

Of the 53 overburden monitoring wells installed during the Phase 2 investigation, only four wells (MW-63A, MW-76A, MW-100A and OB-05A) are true US wells. Four other monitoring wells (MW-25, MW-28, MW-29 and MW-30) installed by OBG were classified as US wells based on WESTON's review of the existing monitoring well logs. Based on an evaluation of the vertical gradients, the soil boring logs and the geographical positions of these eight wells, the water-bearing zones at these locations are indicative of perched water.

Two sets of monitoring well clusters (MW-63, MW-63A and MW-76A/B) were evaluated for vertical hydraulic gradients and indicated a downward trending gradient for two or more of the groundwater level measurement events (Table 4-3). The second and third groundwater level monitoring events (i.e., 19 January 1995 and 16 March 1995) occurred during a high tide cycle and each of the US monitoring wells exhibited higher groundwater elevations for these two rounds, relative to the first round (3 November 1994).

The estimated well yields (Table 3-3) varied for the eight US wells. The values ranged from less than 0.20 gallon per minute (gpm) at OB-05A to 3.75 gpm at MW-100A. A summary of the parameters collected in the field during well purging (Table 3-5, Round 1) indicated that the values for pH ranged from 6.54 (at MW-63A) to 7.90 (at MW-29 and MW-30), with a mean value of 7.40.

There was a significant fluctuation for the final specific conductivity values measured in the US wells. The values ranged from 10 uS/cm (at MW-30) to 16,500 uS/cm (at MW-29). Although this deviation in the range is notable, the salinity data correlates quite well with the conductivity results. The salinity data varied by an order of magnitude in conjunction with a similar change in the specific conductivity. The values for salinity are reported in parts per thousand (ppt) and ranged from 1.0 ppt to 10.10 ppt. Dissolved oxygen values ranged from 1.40 mg/L (at MW-30) to 5.80 mg/L (at MW-76A) and based on the geotechnical results for samples collected in the US unit, the hydraulic conductivity values ranged from 7.03E-08 cm/sec to 1.21E-03 cm/sec (Table 4-1). This variance is likely due to the nature of the US material (i.e., fill material, redistributed natural soils). Field observations during purging activities indicated slight hydrogen sulfide odors at four of the eight US monitoring wells (MW-25, MW-30, MW-63A and MW-76A).

4.3.1.2 Meadowmat Unit

The hydrologic characteristics of the MM unit vary depending on the unit location, thickness and composition (i.e., varying percentages of organics, silt and clay). In general, the MM unit acts as a semi-confining unit separating the US (containing perched groundwater) from the LS. Field logs for soil borings that penetrated the MM unit most often indicated that this material was dry to moist.

Although numerous monitoring wells have screened intervals that straddle the MM unit, only two locations (MW-60 and MW-95A) are screened exclusively within this unit. The soil boring logs for each of these wells indicate that the MM unit was wet with only two to three feet at the surface being dry. Based on the logs for MW-95A and nearby wells (MW-94A and MW-97A/B) and the elevation measurements, the MM unit is under water table conditions.

The estimated well yields (Table 3-3) were only calculated for the wells installed (and developed) as part of the Phase 2 investigation. Therefore, no value exists for MW-60 (installed by Dames and Moore), while the estimated yield for MW-95A was calculated to be less than 0.20 gpm. A summary of the parameters collected in the field during well purging (Table 3-5, Round 1) indicated that the values for pH in groundwater were 6.52 from MW-60 and 6.22 for MW-95A.

The salinity and specific conductivity values correlated well (qualitatively) for MW-95A. Round 2 exhibited an increase in both parameters from Round 1. The salinity values were 3.0 ppt and 7.1 ppt for Rounds 1 and 2 respectively, while the conductivity values went from 5,690 uS/cm to 7,500 uS/cm. The salinity value measured in MW-60 was 12.0 ppt which is typically indicative of a relatively high conductivity value. The specific conductivity value reported was 144 uS/cm. It is suspected that this value is erroneous due to the inconsistency with the measured salinity concentration and a comparison with the other two monitoring wells in that cluster (MW-60B = 11,300 uS/cm and MW-60C = 6,500 uS/cm). Based on the geotechnical results for samples collected in the MM unit, the hydraulic conductivity values ranged from

3.44E-08 cm/sec to 1.24E-04 cm/sec (Table 4-1). This variance is likely due to the heterogeneous composition of the MM material.

The dissolved oxygen value for MW-60 was 1.40 mg/L and varied from 1.20 mg/L (Round 1) to 3.80 mg/L (Round 2) at MW-95A. Field observations during purging activities indicated a very strong hydrogen sulfide odor at MW-95A during the Round 1 sampling event and a slight odor during the Round 2 effort.

4.3.1.3 Lower Sand Unit

The LS hydrologic unit is the main overburden aquifer at the former Arsenal and is believed to be a remnant of the Farrington Sand Member. The saturated thickness for the LS unit ranges from approximately 6 feet at MW-69A to approximately 40 feet near the MW-50 well cluster. A total of 44 monitoring wells were installed in the LS hydrologic unit during the Phase 2 RI. In certain cases, well clusters were installed within this unit so that the entire saturated thickness could be monitored.

As discussed in earlier sections, the stratigraphy of the LS can be quite variable on a local level (i.e., thin layers of silt and clay interbedded with varying percentages of fine to coarse sand). Due to these heterogeneous lithological conditions, the abrupt change in topography on site, and the observed differences in horizontal hydraulic gradients, the hydrologic properties of the LS unit will be evaluated for each of the defined hydrologic zones (Figure 4-9) and on a site-wide basis.

The three rounds of synoptic groundwater elevation measurements (3 November 1994, 19 January 1995 and 16 March 1995) reported on Table 3-13 were used to produce groundwater potentiometric surface maps for each of the measurement dates. The site-wide contours for the LS aquifer are depicted on Figures 4-10, 4-11 and 4-12 and show approximate groundwater flow paths for the northern hydrologic zone. The southern hydrologic zone was also contoured using a one-foot contour interval for better resolution. These contours are depicted on Figures 4-13, 4-14 and 4-15 for each of the respective measurement dates.

The site-wide contour figures exhibit nearly identical potentiometric surface contours for the northern hydrologic zone for each of the three rounds of measurements. The only observed discrepancies occurred in the southern hydrologic zone (refer to the zero contour line on the site-wide figures) and are best illustrated on Figures 4-13, 4-14 and 4-15. As depicted on these figures, groundwater generally flows in a southeasterly direction towards the Raritan River. The steep contour lines in the northern and central portions of the former Arsenal indicate that the LS aquifer is generally mirroring the surface topography (Figure 4-1). In the southern hydrologic zone (i.e., contours less than 10 feet above MSL) horizontal hydraulic groundwater gradients decrease significantly and groundwater flow is toward the local surface drainage features of Red Root Creek, Old Red Root Creek, Black Ditch and the Raritan River.

The LS is tidally influenced as illustrated on the one-foot potentiometric maps (Figure 4-13 versus Figures 4-14 and 4-15). For Figures 4-14 and 4-15 the groundwater elevation data were collected at or near high tide in the Raritan River, which accounts for the higher groundwater elevation contours in the vicinity of the three surface drainage features mentioned above (Figure 4-14). General groundwater flow direction(s) remained constant for each of the measurement dates and the flow appears to be influenced by the surface drainage bodies for elevations at or below 2 to 3 feet above MSL.

The hydraulic gradients for select monitoring well clusters are reported in Tables 4-2 through 4-5. Table 4-2 summarizes the horizontal gradients in each hydrologic zone and on a site-wide basis. The average horizontal hydraulic gradient for the northern zone was 0.0090 feet/feet. The average value calculated for the southern zone was 0.0011 feet/feet, nearly an order of magnitude less than the northern zone. Due to the fact that there are two distinct hydrologic zones (Figure 4-9), sitewide horizontal gradients were not calculated. The hydraulic gradients, if averaged, would skew the gradient values (because of steeper gradients in the northern hydrologic zone, and flat gradients in the southern zone).

Table 4-3 summarizes the vertical hydraulic gradients for deep versus shallow overburden monitoring wells. In nearly every example (i.e., well cluster evaluation), the predominant trend was a downward hydraulic gradient. In the limited cases where the resultant was an upward gradient, the difference in groundwater elevations was so small (approximately 0.01 ft) that it could be considered insignificant. The average vertical gradient for the overburden monitoring well clusters that were evaluated was calculated to be -0.0797 feet/feet (downward). It should be noted that only one cluster (MW-55A/B) is located in the northern hydrologic zone. Three of the well clusters evaluated compared a LS monitoring well to an US monitoring well (MW-28B and MW-28, MW-63 and MW-63A, MW-79B and OB-05A). In each of these cases and for each measurement event, the vertical gradient was notably downward, indicating that the groundwater in the US unit was perched (i.e., on top of the MM unit).

Table 4-5 presents the vertical hydraulic gradients for well clusters where bedrock and overburden monitoring wells could be compared. Two cluster locations in the northern hydrologic zone (MW-74 and MW-103) and three cluster locations in the southern zone indicated an upward hydraulic gradient for two or more of the measurement events. The average vertical gradient calculated for the entire site, taking into account all three measurement events was -0.0116 feet/feet (downward). This downward vertical gradient suggests there is the potential for groundwater to flow from the LS into the bedrock. But, given the generally very low hydraulic conductivity of the Weathered Bedrock Group (namely the Raritan Fire Clay) versus the generally moderate hydraulic conductivity of the LS, it is highly likely that the LS drains to the local surface water bodies. There is likely very little, if any, groundwater flux between the LS and bedrock aquifers.

The estimated well yields (Table 3-3) varied significantly for the LS monitoring wells. The values ranged from 0.25 gpm (at MW-81A) to greater than 10.0 gpm (at MW-70A and MW-76B). The average estimated yield for wells in the southern zone was 3.9 gpm, while in the northern zone the average was 3.4 gpm.

A summary of the results for parameters collected in the field during well purging is presented in Table 3-5. The values for pH ranged from 1.40 (at MW-22, believed to be erroneous) to 8.99 (at MW-97A). The average pH value for the LS groundwater was 5.88. Dissolved oxygen values for the LS aquifer ranged from 0.1 mg/L (at MW-91A) to 8.30 mg/L (at MW-77B).

The final specific conductivity and salinity measurements for the LS unit exhibited a tremendous range of values. The values for specific conductivity ranged from 1 uS/cm (at MW-105A) to 19,150 uS/cm (at MW-99B). Although this deviation in the range for conductivity is notable, the salinity data in general appears to correlate well with the conductivity results. The salinity data varied by an order of magnitude in conjunction with similar changes in the specific conductivity. The values for salinity ranged from 0.0 ppt at numerous locations in the northern hydrologic zone to 17.0 ppt (at MW-63). In general, most of the high values for these parameters were measured in wells that are in the southern zone and susceptible to tidal influences. Based on the Round 1 purge data, the site-wide salinity results indicated that at least half of the site (namely the southern hydrologic zone) exhibited salinity values in excess of 0.5 ppt (the NJDEP standard for TDS in Class IIA aquifers).

Based on the geotechnical results for samples collected in the LS unit, the hydraulic conductivity values ranged from 6.88E-08 cm/sec to 7.50E-04 cm/sec (Table 4-1). This variance is due to the heterogeneous nature of the LS material.

Field observations during purging activities indicated slight hydrogen sulfide odors at four monitoring well locations (MW-15, MW-16, MW-76B and MW-84A).

4.3.1.4 Raritan Fire Clay Unit

The Raritan Fire Clay unit is the upper stratigraphical unit within the Weathered Bedrock Group and was observed immediately above the weathered Passaic unit. Based on Phase 2 field investigations, and a reference to the unit in Geology and Ground-Water Resources of the Rahway Area, New Jersey (Anderson, Special Report No. 27, 1968), the Raritan Fire Clay is acting as a confining unit at, and in the vicinity of the former Arsenal. This unit is believed to be an effective aquitard between the overburden and bedrock hydrological units, except in the area of the site near MW-49C, where the unit was absent.

Based on the literature and previous investigations, the Raritan Fire Clay unit was not considered to be a potential water-bearing zone, and therefore, no wells were proposed or installed to monitor this unit during the Phase 2 RI. Upon review of monitoring well logs for wells installed by OBG, it appears that one well (MW-31) was installed with a screened interval that intercepted approximately four feet of this unit and six feet of the weathered Passaic unit. Additionally, due to the thin nature of the saprolite deposits, no wells were proposed or installed in this unit.

Based on field observations, the Raritan Fire Clay unit was logged as moist, dense and increasingly friable with depth. The geotechnical results (Table 4-1) reported hydraulic conductivities ranging between 2.81E-08 cm/sec to 1.44E-06 cm/sec. The moisture content of the Raritan Fire Clay samples was reported to be between 28.9 and 49.6 percent, not uncommon for high plasticity silts and clays.

4.3.2 Bedrock Hydrogeology

Based on the results of the geologic and hydrologic investigation at the former Arsenal, the bedrock aquifer is comprised of three differing lithologic units. The red beds of the Passaic Formation were encountered in the northern portion of the site and grade into the gray slate-like unit (or altered PAS unit) in the central portion of the site. This region of the PAS was altered due to contact metamorphism with the Palisades Sill Formation, which was encountered in the southern quarter of the site. Hydrologically, these units are believed to be connected through a network of fractures.

For the purposes of evaluating the groundwater flow direction, hydraulic gradients and groundwater quality at the former Arsenal, a total of 20 groundwater monitoring wells were installed within the bedrock hydrologic zone. Eight of the 20 monitoring wells were installed within the PAS Formation, 10 were installed within the altered PAS zone, and two wells were installed in the PAL Formation (Figure 4-6).

Three complete rounds of groundwater elevation measurements of the bedrock monitoring wells were performed on 3 November 1994, 19 January 1995 and 16 March 1995. The potentiometric surface contour maps are illustrated on Figures 4-18, 4-19 and 4-20 and the groundwater elevation data are presented in Table 3-13. These figures indicate that bedrock groundwater flow is in a southeasterly direction towards the Raritan River (very similar to the flow direction for overburden groundwater).

Horizontal hydraulic gradients were calculated for all three measurement events and these data are presented in Table 4-4. As was done with the overburden groundwater gradients, the horizontal gradients were calculated for wells that are present in the northern and southern hydrologic zones. The average horizontal hydraulic gradient for the northern hydrologic zone (average of three measurement events) was 0.0075 feet/feet. The average for the southern zone was calculated to be 0.0013 feet/feet. Due to differences between the types of bedrock, WESTON determined that the calculation of site-wide horizontal hydraulic gradients would skew or misrepresent actual conditions.

Table 4-5 presents the vertical hydraulic gradients for well clusters where bedrock and overburden monitoring wells could be compared. Two cluster locations in the northern hydrologic zone (MW-74 and MW-103) and three cluster locations in the southern zone indicated an upward hydraulic gradient for two or more of the measurement events. The average vertical gradient calculated for the entire site, and taking into account all three measurement events was -0.0116 feet/feet (downward). This indicates that the potential exists for groundwater from the LS unit to flow into the bedrock hydrologic unit. But, the general downward gradient is more likely due to the fact that the water level measurements in Rounds 1 and 2 were collected during high tide.

The estimated well yields (Table 3-3) varied significantly for the bedrock monitoring wells. The values ranged from 0.10 gpm (at MW-104C) to greater than 10.0 gpm (at MW-76C). The average estimated yield for wells in the southern zone was 3.0 gpm, while in the northern zone the average was 0.75 gpm.

A summary of the results for parameters collected in the field during well purging is presented in Table 3-5. The values for pH (both rounds) ranged from 2.96 (at MW-104C) to 11.11 (at MW-49C). The average pH value for the bedrock groundwater during Round 1 was 7.82 and during Round 2 was 7.16. These values are higher than the average value of 5.88 for the overburden groundwater (LS unit). Monitoring wells that exhibited a change of more than two units of pH between the two rounds include MW-49C, MW-59C, MW-88C, MW-90C, MW-103C and MW-104C. The range for dissolved oxygen values for the bedrock aquifer (both rounds) was from 0.5 mg/L (at MW-49C and MW-79C) to 5.60 mg/L (at MW-104C).

For the first round (Round 1) of bedrock monitoring well purging and sampling the final specific conductivity values ranged from 1 uS/cm (at MW-105C) to 16,840 uS/cm (at MW-96C). The range for Round 2 was from 2 uS/cm (at MW-86C and MW-87C) to 2,790 uS/cm (at MW-79C). The majority of the bedrock groundwater samples exhibited conductivity values below 1,000 uS/cm, as opposed to the overburden samples, where the majority exceeded 1,000 uS/cm. The salinity values for the bedrock groundwater samples were in general, much less than those observed in the overburden. The Round 1 salinity values ranged from 0.0 (at numerous locations) to 12.0 ppt (at MW-60C) and the range for Round 2 was from 0.0 to 14.0 ppt (at MW-90C).

Field observations during the Round 1 purging activities indicated slight hydrogen sulfide odors at monitoring well location MW-76C. A PHC odor was detected at MW-6C and a hydrogen sulfide odor was noted at MW-75C during Round 2 activities.

4.4 SURFACE WATER HYDROLOGY AND POTENTIAL GROUNDWATER HYDRAULIC CONNECTION

The former Arsenal site is located on the northern side of the Raritan River, which discharges to Raritan Bay approximately 5 miles to the east. Much of the former Arsenal site lies within the 100-year floodplain calculated by the Federal Emergency Management Agency (FEMA). The 100-year floodplain is between 10.1 and 12.1 feet above MSL. The FEMA 500-year floodplain line is located slightly north of the FEMA 100-year line, with a portion of the two lines being shared. Both lines follow site topography. North of these lines, site elevation rises abruptly.

Seven major drainage areas were identified within the former Arsenal during the Phase 2 RI surface water/sediment investigation:

- East Ditch Drainage;
- Black Ditch Drainage;
- Red Root Creek Drainage;
- Central Ditch Drainage;
- Area 12 Drainage;
- Old Red Root Creek Drainage; and
- County Park Area Drainage.

Except for the Area 12 and County Park drainage, the drainage areas originate within freshwater areas, but are estuarine in their lower sections, due to the influence of the Raritan River. Due to the level terrain of much of the site and the nature of past disturbance to site hydrology, these drainage areas are only an approximation, and in some cases the drainages are in hydraulic communication with each other. Detailed delineation of watersheds would require analysis and mapping beyond the scope of the Phase 2 RI surface water investigation. Figure 4-22 presents the location of the seven drainage areas and shows the main surface water features within each of the drainage areas. The main surface water features within each drainage area are also described below. Specific discussions relating to each surface water feature is presented in the site-wide surface water and sediment report dated May 1995.

The East Ditch Drainage (Drainage Area 1) refers to surface water features in the northeastern portion of the site, including all surface water features within Area 14. Surface water features addressed in this drainage area include two streams identified as the unnamed tributary and the East Ditch.

The Black Ditch Drainage (Drainage Area 2) originates north of Areas 4 and 5, and includes these areas, part of Area 6, and extends southward to include all of Black Ditch. Identifiable surface water features within this drainage include the Area 4 drainage ditch, a small pond in Area 5 and Black Ditch itself.

The Red Root Creek Drainage (Drainage Area 3) includes streams located or originating in Areas 1, 18A, 18B and 18C in the northwestern portion of the former Arsenal. These drain in a southeasterly direction into Red Root Creek. The drainage also includes a drainage ditch in Area 20, and sulfur plant ponds in Areas 6 and Area 8 ponds.

The Central Ditch Drainage (Drainage Area 4) includes the Central Ditch, located in the southeastern part of the former Arsenal, and associated ponded areas in Area 16. Some of these ponded areas are connected to the ditch, and others appear to be hydrologically isolated, except perhaps during major storm events.

The Area 12 drainage (Drainage Area 5) includes two ditches which carry runoff from Area 12 into the Raritan River. A narrow tidal ditch running in a southwesterly direction, carries flow into the Southwest Ditch (described below). Observations made during the investigation indicate that this ditch is not well defined. A second ditch along the eastern edge of Area 12 runs north to south, parallel to March Road. A portion of the flow apparently feeds into the above ditch, and eventually into the Southwest Ditch, but most empties directly into the Raritan River.

The Old Red Root Creek Drainage (Drainage Area 6) encompasses much of the southwestern portion of the former Arsenal. It includes wetland areas within Area 19, Old Red Root Creek itself, West Ditch, and associated ditches in the southwestern portion of Area 16, and the Southwest Ditch. Most of this drainage system flows into the Raritan River via the West Ditch, although a minor portion in the southern part of Area 16 may drain into the Southwest Ditch.

The County Park Drainage (Drainage Area 7) consists of a series of ditches constructed within the Thomas Edison County Park property in Area 10. These ditches carry runoff into the Raritan River via a large off-site ditch, running along the outer western boundary of the former Arsenal site.

Surface water features on the former Arsenal site can be categorized as either freshwater or estuarine. Based on field salinity measurements and observations of tidal flow, the approximate extent of freshwater (FW-2) and estuarine (SE-1) waters is shown in Figure 4-22. This approximate boundary is based on instantaneous field measurements, and does not take into account salinity fluctuations which might occur due to changes in precipitation, seasonal or annual fluctuations in groundwater, tides, or sampling variability.

The northern third of the site contains several freshwater features, defined as having salinity values less than 3.5 ppt. These include streams, ponds, and wetlands. Additional freshwater features include the upper reaches of Red Root Creek and some of the ponded areas in the southeastern portion of the site. Most of the lower portion of the site, however, is estuarine, consisting of tidal marsh areas which are drained by Red Root Creek as well as a network of ditches.

Field observations during the August 1994 sediment/surface water sampling event indicate that tidal flow in these ditches occurs at a different rate than in the Raritan River. The flow rate in the ditches may be partially influenced by a series of tidal gates at the base of major ditches such as Black Ditch, Central Ditch, Southwest Ditch and West Ditch. Nearly all of these gates remain open at present, but the presence of headwalls, culverts, and in some cases, closed or partially closed gates, may act to influence the rate of tidal flow.

In order to evaluate the potential hydraulic connection between surface water and groundwater within the drainage areas, water elevations obtained from staff gauges during three rounds of water level measurements were compared to groundwater elevations in one or more nearby monitoring wells. Table 4-6 presents a summary of surface water versus groundwater elevations.

It should be noted that these comparisons are based on variable site conditions and water level elevations may change due to rainfall events, tidal influence and seasonal variations. In addition, both the Round 2 and Round 3 water level events were performed during high tide. Although differences in water elevations suggest the potential for hydraulic connection between surface water and groundwater, the presence of confining or semi-confining units (i.e., MM unit) may act as a barrier to hydraulic connection. The presence of the MM unit may cause water elevations in LS monitoring wells to rise above the elevation of the surface water under confined or semi-confined conditions. Preliminary results from the Phase 2 RI indicate the following:

- Groundwater in Drainage Area 2 is potentially discharging to Black Ditch. However, meadowmat has been reported in this portion of the site. In addition, several measurements indicated that surface water from Black Ditch may at times be discharging to groundwater. This discrepancy is likely due to tidal fluctuations in Black Ditch and runoff from the rain events the week prior to the Round 2 water level event.

- Groundwater in the northern portion of Drainage Area 3 is potentially discharging to the Area 18B streams. Since the MM unit was not reported in this portion of the site is likely that the Area 18B streams are hydraulically connected to groundwater within the LS aquifer. Surface water in the southern portion of Drainage Area 3 is potentially discharging to groundwater; however, the MM unit is present in this portion of the site.

- In Drainage Area 4, surface water is potentially discharging to groundwater; however, the MM unit is present in this portion of the site.

- In Drainage Area 6 surface water is potentially discharging to groundwater; however, the MM unit is present in this portion of the site.

- Surface water from the Raritan River is potentially flowing onto the former Arsenal. Dredge spoils and the MM unit are present along the southern portion of the site, potentially influencing the hydraulic connection of groundwater and surface water.

4.5 TIDAL INFLUENCE INVESTIGATION

Two rounds of surface water and groundwater level measurements were conducted to determine the impact of tide-induced water level fluctuations on groundwater levels, hydraulic gradients, groundwater flow direction and potential contaminant migration (Figure 4-23). The data collected, and graphical plots of the tidal fluctuations over time are provided in Appendix G.

Tidal influence measurements were collected both manually and with data loggers. The data loggers were In Situ Well Sentinels with 5 psi transducers. An In Situ Hermit SE 2000 was also used at one location. The Hermit has an eight channel capacity with multiple transducers collecting data at one minute intervals during Round 1 and two minute intervals during Round 2. The data was downloaded by computer into a ASCII formatted file using In-Situ Inc. data conversion software.

Groundwater elevation data were evaluated for both barometric and tidal effects. For data analysis, monitoring well locations were sub-divided into three categories: overburden wells which displayed tidal characteristics, overburden wells that displayed only barometric characteristics, and bedrock monitoring wells which displayed tidal influence characteristics. Although tidally-influenced monitoring wells were also affected by fluctuations in barometric pressure, the influence of barometric pressure was considered negligible relative to tidal effects.

Data from monitoring wells that were screened in the overburden and which displayed only barometric fluctuation were plotted against the inverse of barometric pressure. The barometric pressure was measured at a central location within Area 8, adjacent to well MW-79. The site-specific barometric data were compared to data collected in New Brunswick by the Rutgers University Department of Meteorology. Comparison of site-specific barometric data collected during both sampling rounds with the Rutgers University data confirmed that the data closely coincided, and that the site-specific results could be extrapolated from the single location measured for use throughout the site.

Barometric efficiency was calculated in order to evaluate observed water level fluctuations in non-tidally influenced wells, and is a measure of the tendency of the water level to reach an equilibrium while barometric pressure fluctuates. It is measured as the ratio of the standard deviation of the monitoring well water level over the test period to that of the barometric pressure results for the same time period.

Similarly, the tidal efficiency of wells was calculated for all wells that displayed tidal influence characteristics in order to determine the extent to which observed water level fluctuations were attributable to tidal changes. Tidal efficiency can be defined as the ratio of the standard deviation of the water level in the well to that in the tidal water feature potentially influencing it.

Overburden wells in close proximity to the tidal body may be influenced by tidal fluctuation, since an increase in the water level of the tidal body can send a pressure wave through the LS overburden aquifer. The magnitude and frequency of the pressure wave are proportional to tidal fluctuations in the tidal body.

Wells that penetrate semi-confined, or confined aquifers may exhibit tidal fluctuations at a greater distance from the tidal body. This is because the fluctuation in water level is due to a change in pressure in the aquifer rather than an actual change in the water level in the aquifer. A change in the tide stage, and thus the weight of water in the tidal body, causes a subsequent increase or decrease in the pressure applied to the semi-confined or confined aquifer. The tidal effects on an aquifer can be present whether the aquifer is directly linked to the tidal body via a sub-outcrop or if the aquifer is confined beneath the tidal body.

Staff gauges located in surface water features throughout the site were evaluated to determine the extent of tidal influence on the surface water. The tidal efficiency was calculated using the same methods as described for tidally-influenced wells. Those staff gauges that are coupled with adjacent monitoring wells were used to evaluate localized tidal influence. Tidal efficiencies and time lags were calculated with respect to the adjacent surface water monitoring locations, in order to quantify the effect of the Raritan River and adjacent tidal streams on groundwater levels.

4.5.1 Results of Round 1 Tidal Influence Investigation

The Round 1 tidal monitoring event was conducted from 16 January through 20 January, 1995. The first three days of the event were spent primarily on mobilization of equipment and activation of the data loggers. The weather during this time period was scattered with rain events and the barometric pressure was falling throughout the event. A graph displaying both of these trends is included in Figure 4-24. The considerable amount of rainfall in the days prior and during the evaluation period resulted in a higher than usual tide stage. The effects of increased precipitation prior to, as well as scattered precipitation during the tidal influence survey, resulted in less fluctuation in water levels. The precipitation and runoff limited the effect of tidal influence during Round 1 on the former Arsenal. The earliest common time for all locations was 1406 on 18 January 1995 and the first well sentinel was removed at 0830 on 20 January 1995.

During the Round 1 tidal influence monitoring event, 30 locations were chosen for monitoring. At 18 of these locations, water levels in monitoring wells were measured and at 12 locations water levels were measured at staff gauges. At three of the 18 monitoring well locations (MW-

77A, MW-94A and OB-05A), pressure transducers stopped functioning at some time after test activation. The remaining 15 well locations consisted of five bedrock well and 10 overburden well locations. Each of the 12 staff gage pressure transducers were operational throughout the length of the monitoring event. Of the twelve staff gauges monitored, two (SG-16 and SG-17) did not exhibit tidal influence, while SG-1, SG-2, SG-4, SG-5, SG-8, SG-9, SG-10, SG-11, SG-13 and SG-15 exhibited varying degrees of tidal influence. Table 4-7 summarizes the Round 1 data, including tidal efficiency for the tidally influenced wells and staff gauges.

Two staff gauge locations, SG-1 and SG-2, were situated on the Raritan River. The water level data from staff gauge SG-2 provided the only full set of data for the Raritan River, since during low tide periods the water level at SG-1 dropped below the bottom of the staff gauge. Thus, the values recorded from SG-2 were considered to be representative of the Raritan River in the vicinity of the former Arsenal.

Four of the overburden wells (MW-90A, MW-93A, MW-96A, and MW-99A) displayed tidal characteristics. The tidal fluctuation in these wells can be attributed to fluctuation in the Raritan River water level or fluctuation in the water level of some of the smaller surface water features within the former Raritan Arsenal. Tidal efficiencies were calculated for each of these monitoring locations with respect to the closest staff gauge within the surface water body adjacent to the monitoring well location.

The well with the largest tidal deflection (MW-96A) is located at a distance of approximately 440 feet from the Raritan River. The screen interval for this well is at an elevation of -36.4 through -50.4 feet MSL, within the LS aquifer. A layer of meadowmat and/or dredge spoils 30 feet thick separates the US aquifer from the LS aquifer. The tidal deflection in the water level is approximately 2.31 feet and the corresponding tidal efficiency is 26.67% with respect to SG-2. A plot of the water level elevation in well MW-96A and staff gauge SG-2 is presented in Figure 4-25. The water level elevation of the Raritan River is higher than the water level elevation of well MW-96A throughout most of the daily tidal cycle. Since MW-96A displays tidal influence and the water level elevation is lower than that of the river, except at low tide, it can be inferred that groundwater flow moves inland from the river during a portion of the tidal cycle. The LS aquifer is apparently receiving water from the Raritan River via a sub-outcrop at this location.

A small tidal deflection of approximately 0.05 feet was measured at MW-93A, located approximately 2,250 feet from the Raritan River. The corresponding tidal efficiency was 4.53% with respect to SG-2 on the Raritan River. Between MW-93A and the Raritan River are a number of small ponds within the Central Ditch Drainage, most of which are not tidally influenced. As per the results of the pre-test, surface water levels in the Central Ditch at staff gauge SG-7, located adjacent to well MW-93A, exhibited no tidal fluctuation. Although the Central Ditch hydraulically connects these surface water ponds to the Raritan River, tidal fluctuations are primarily limited to its lower end, where, during a majority of the daily tidal cycle, it flows outward into the Raritan River. During high tide, the flow direction is reversed and water from the Raritan River flows into the ditch. A well sentinel attached to SG-8 monitored the water level at the base of the Central Ditch, and a plot of water levels at well MW-93A and staff gauge SG-8 is provided in Figure 4-26. The slight deflection observed in MW-93A is attributed to the Raritan River and to a lesser extent, the Central Ditch.

Monitoring locations MW-90A and MW-99A are located adjacent to large tidal streams that are greatly affected by the water level of the Raritan River. Old Red Root Creek flows adjacent to MW-90A, and MW-99A is located between Red Root Creek and Black Ditch. MW-90A is screened in the LS aquifer between -7.12 and -12.12 feet MSL. The tidal fluctuation observed in this well is apparently primarily due to the influence of Old Red Root Creek. Staff gauge SG-13 was installed on Old Red Root Creek within 50 feet of MW-90A. The tidal efficiency is 86.53% when calculated with respect to SG-13. The surface water elevation at SG-13 is consistently higher than the water level elevation in MW-90A, suggesting leakage from Old Red Root Creek to the LS groundwater aquifer in this region. Figure 4-27 shows the relationship between MW-90A and SG-13.

The staff gauges associated with MW-99A are SG-9 and SG-10 located on Red Root Creek and Black Ditch respectively. The well screen for MW-99A is also placed in the LS from -7.75 to 17.75 feet MSL. A plot of the water level elevation in MW-99A and the water levels at staff gauges SG-9 and SG-10 are provided in Figure 4-28. It appears that the tidal cycles for Red Root Creek, Black Ditch and MW-99A coincide, and that the groundwater elevation in MW-99A is higher than the local surface water.

The remaining six overburden wells (MW-50A, MW-60, MW-61, MW-76B, MW-79B, and MW-80A) did not show tidal influence, and the change in water levels in these wells is attributable to the barometric pressure. The barometric efficiency was calculated for each of these wells and ranged from 12.5% through 48.3%. A list of all of the barometric efficiencies and a graph of inverse barometric pressure versus water level elevation are provided in Table 4-8 and Figure 4-29. Generally these wells are located at a distance of more than 2,000 feet from the Raritan River and are not adjacent to any of the smaller tidally-influenced water bodies. The two exceptions are wells MW-50 and MW-60, which are located within 250 feet and 1,100 feet of the Raritan River, respectively. Both MW-50 and MW-60 were screened within the US or meadowmat hydrologic unit. Plots of the water level elevations for each of these wells compared to the Raritan River (SG-2) suggest that the groundwater is perched at these locations. The boring logs of both of these locations state that a saturated layer was encountered above the meadowmat and that a dry to moist layer of meadowmat was observed before the saturated LS aquifer. The water level plots for MW-50 and MW-60 are presented in Figures 4-30 and 4-31, respectively.

Although all of the bedrock monitoring wells displayed tidal characteristics, the total deflection ranged from 0.11 feet to 0.80 feet. The tidal efficiencies were also small, ranging from 1.25%

to 7.7% respectively. Figure 4-32 displays the relative magnitude of all of the bedrock wells monitored during Round 1. The starting position of each well was adjusted, so that all wells are seen in phase. Groundwater flow in the bedrock aquifer is consistent with the regional groundwater flow direction. The bedrock aquifer and the Raritan River are hydraulically connected (via discharge from the bedrock aquifer to the river) based on the tidal study. Tidal influence is observed in bedrock wells based on oscillation deflection observed in water levels. Higher deflections in bedrock water levels were observed at wells closer to the river than at wells further away from the river. The oscillations or deflections in water levels are not significant enough to reverse the flow of bedrock groundwater to the river. Groundwater flow in the bedrock aquifer is ultimately discharging to the Raritan River.

4.5.2 Results of Round 2 Tidal Influence Investigation

The Round 2 tidal monitoring event was conducted from 13 March through 17 March, 1995. The weather during this period was mostly clear, with little to no rain, and only slight changes in barometric pressure were recorded. These conditions were different from those during Round 1, when precipitation occurred before and during the study. The effect of clear weather (i.e., no precipitation) resulted in greater tidal influence being observed at the former Arsenal. The earliest common monitoring time for all locations was 1631 on 16 March 1995 and the first Well Sentinel was removed at 0800 on 17 March 1995.

Staff gauges were not placed at SG-1 or SG-7 during this round of tidal monitoring. SG-1 was eliminated because the water level was below the bottom of the staff gauge for a large portion of the tidal cycle during the Round 1 monitoring event. The well sentinel from SG-1 was moved to staff gauge location SG-6 on Red Root Creek. This location was chosen to determine magnitude of tidal fluctuation immediately upstream from the culvert at the base of Red Root Creek. The well sentinel from staff gauge SG-7 was placed at monitoring well MW-91A because it is an intermediate position between the monitoring well cluster at MW-60 and MW-90. These modifications were based on the results of the Round 1 tidal influence monitoring event.

The Well Sentinel placed at SG-2 did not function properly during the Round 2 monitoring period. This staff gauge location was the primary measurement point of the water level on the Raritan River for Round 1 and Round 2. In order to quantify the fluctuation in the water level of the Raritan River without full data from SG-2, the results from three functioning Round 2 monitoring wells (MW-50C, MW-60 and MW-90A) were compared with the respective Round 1 results. The ratio of the Round 2 water level standard deviation to the Round 1 water level deviation yielded an average value of 81.53%. Multiplying the Round 1 standard deviation for SG-2 by 81.53% yields an estimate of the SG-2 standard deviation for Round 2. In the absence of full data from SG-2 due to equipment malfunctioning, this value was utilized to calculate the tidal efficiencies for both wells and staff gauges for Round 2.

Round 2 water levels at some locations were influenced by ongoing site activities. The current property owner of the southeastern section of the former Raritan Arsenal, Federal Business Centers (FBC), performed maintenance operations on the tidal gates at the base of Red Root Creek and Black Ditch. A representative of FBC informed WESTON that the corrective action was necessary to allow a contractor access to a worksite. The tidal gates are to remain in the closed position indefinitely. The effect of closing the tidal gates on Red Root Creek was slight, the total water level deflection dropped approximately 0.41 feet between Round 1 and Round 2. However, a dramatic reduction in the amount of water entering Black Ditch was noticed during Round 2. Both SG-10 and SG-11 had total water level deflections of approximately 4.44 and 2.69 feet less than the corresponding Round 1 results.

The Well Sentinel at MW-96A was not functional over the entire test period. The results obtained from this location are sufficient only to compare the magnitude of tidal fluctuation with the results of the Round 1 monitoring event. The water level fluctuation at MW-96A was 2.31 feet during Round 1 as compared to 1.43 feet during Round 2.

During the Round 2 tidal monitoring event, six overburden wells displayed tidal fluctuation. MW-90A, MW-93A, MW-96A and MW-99A displayed similar results to those observed during the Round 1 monitoring event. Two additional wells, MW-94A and MW-91A, also displayed tidal characteristics. The Well Sentinel at MW-94A was not operational during the Round 1 monitoring event and MW-91A was a newly chosen location. Figure 4-33 shows the relationship between MW-91A and SG-4 during the tidal cycle.

Overall, the tidally influenced overburden monitoring wells had consistent tidal characteristics between monitoring events. See Table 4-7 for the deflections and tidal efficiencies. The average water level at MW-99A decreased from 2.50 feet MSL during Round 1 through 1.59 feet MSL during Round 2. The decreased water level is believed to be due to the repair of the tidal gates at the base of Black Ditch and Red Root Creek. Figure 4-28 shows that the water level elevation in MW-99A was above the water level of SG-9 and SG-10 over the entire monitoring event. The groundwater between Red Root Creek and Black Ditch will travel toward each of the surface water bodies, and surface water streams apparently gain water from the groundwater.

The overburden wells that did not display tidal influence during Round 1 (MW-50A, MW-60, MW-61, MW-76B, MW-79B and MW-80A) displayed similar results during Round 2. Two additional wells MW-77A and OB-05A also showed only barometric fluctuation. The barometric efficiency for Round 2 ranged from 17.33% through 190%.

During Round 2, the same five Round 1 bedrock wells (MW-50C, MW-60C, MW-76C, MW-79C and MW-96C) were again monitored for tidal fluctuation. Table 4-7 presents the tidal efficiencies for these wells.

4.5.3 Effects of Tidal Influence on Site-Wide Hydrology

The results derived from the tidal influence investigation, regarding the hydrogeology at the former Arsenal are as follows:

- All observed instances of groundwater in the US unit are not influenced by the tidal cycle in the Raritan River.
- The Raritan River influences the LS unit groundwater levels up to a distance of 2500 feet inland from the southern river boundary.
- Smaller tidal bodies on the former Arsenal have an influence on the groundwater tidal fluctuations up to a distance of 500 feet.
- All bedrock wells monitored display tidal fluctuations. However, the magnitude of the tidal fluctuation is not sufficient to alter the direction of groundwater flow.

4.6 HYDRAULIC CONDUCTIVITY TESTING

According to the Phase 2 WESTON workplan, hydraulic conductivity testing of three production wells was to be performed at the former Arsenal. The purpose of these aquifer tests was to determine hydraulic conductivity (K) values for the aquifers of concern. However, with the overall responsibility of the former Arsenal project change from KCD to NED, the NED management decided to suspend hydraulic conductivity testing until groundwater contamination above ARARs was detected and confirmed. This policy is consistent with the DERP-FUDS Program, which states that work will not performed without a technical reason. Based on a review of Sections 5.0 and 6.0, (analytical results and conclusions), recommendations will be made with regard to aquifer testing.

Based on OBG 1989 report, insitu permeability testing (slug test) was performed on seven groundwater monitoring wells. These wells (MW-7, MW-13, MW-16, and MW-34) were screened in the LS hydrologic unit. The LS unit hydraulic conductivity values (based on Hvorslev, 1951), range from 60 to 2600 gal/day/ft2. The US wells (MW-26 and MW-28) had hydraulic conductivity values (based on Hvorslev, 1951) that range from 361 to 3465 gal/day/ft^2.

Results of laboratory permeability tests performed on geotechnical soil samples collected from the various unconsolidated soil units at the former Arsenal are presented in Table 4-1.

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SECTION 5.0

GROUNDWATER QUALITY

The nature and extent of groundwater contamination at the former Arsenal were evaluated based on:

- The analytical results of groundwater sampling conducted during previous investigations.
- The SGWS survey performed during the Phase 2 RI of expedited sites.
- The analytical results of two rounds of groundwater sampling performed during the Phase 2 RI of non-expedited sites.
- The supplemental hydrogeological investigation performed during the Phase 2 RI of the former Arsenal.

Tables 5-1 and 5-2 summarize the groundwater analytical results from the previous OBG and Dames & Moore investigations. Tables 5-3 through 5-11 summarize the groundwater analytical results for compounds or analytes that exceeded the NJDEP Class IIA Groundwater Quality Standards (GWQS) during at least on of the two rounds of groundwater sampling performed during the Phase 2 RI. Summary tables of the QA/QC analytical data during two rounds of sampling are presented in Appendix H. Summary tables presenting all compounds detected in groundwater samples collected during the two rounds of Phase 2 RI sampling are presented in Appendix I. Groundwater sample laboratory deliverable reports have been submitted to the USACE MRD laboratory for QA evaluation.

The following sections discuss the groundwater analytical results, including the findings of previous USACE contractors (OBG and Dames & Moore) plus WESTON SGWS results, monitoring well sampling results and QA/QC sampling performed during the Phase 2 RI. Analytical results are evaluated based on NJDEP Class IIA GWQS and specific contaminants of concern are identified.

5.1 SUMMARY OF GROUNDWATER QUALITY DETERMINED DURING PREVIOUS INVESTIGATIONS

5.1.1 OBG Sampling Results

During the months of November and December of 1988 and January 1989, OBG conducted groundwater sampling at the former Arsenal. Based on OBG's Final Engineering Report (November 1989), a total of 30 monitoring wells were sampled to evaluate groundwater quality and the nature and extent of any groundwater contamination. Of the 30 monitoring wells installed, 17 monitor the LS aquifer, three monitor the US water bearing zone, two monitor the US/MM unit, two monitor the US/MM/LS units and one well monitors the MM unit. Five of the 30 OBG wells have not been found and are assumed destroyed or covered by recent construction. The OBG wells and screened intervals include MW-4 (US, LS), MW-5 (US, LS, WBK), MW-35 (US, LS, WBK), MW-36 (US, LS, WBK) and MW-37 (US, LS, WBK).

MW-4 and MW-5 are associated with Area 9. These wells are assumed to be destroyed as part of the construction of buildings in Area 9. Monitoring wells MW-35, MW-36 and MW-37 are located in Area 15. These wells are assumed to be destroyed as part of the construction of Area 15. However, without surveying (and possible excavation) of all of these locations, a true determination concerning the potential continued presence of the wells can not be made. Groundwater samples from the OBG wells were analyzed for VOC, metals (total), total petroleum hydrocarbons, explosives, explosive indicator compounds and general indicator parameters (Table 5-1).

The analytical results indicated that seven of 30 overburden monitoring wells exhibited VOCs at concentrations exceeding the NJDEP GWQS. Total VOCs detected in monitoring wells with GWQS exceedances were as follows: MW-4 (642 ug/L) in Area 9, MW-7 (5.0 ug/L) in Area 1, MW-8 (178 ug/L) in Area 1, MW-9 (7.0 ug/L) in Area 1, MW-13 (61.0 ug/L) in Area 2, and MW-14 (6.0 ug/L) in Area 2. Three of the 30 monitoring wells installed were screened in the deeper overburden water bearing unit classified by WESTON as the LS aquifer. Of these three deeper wells, only MW-31 (screened within the LS and WBK Group) located within Area 1 had detectable VOC contamination. The groundwater sample collected from MW-31 had a total VOC concentration of 267 ug/L.

Specific VOC contaminants that exceeded the NJDEP GWQS during the OBG groundwater investigation included: TCE, 1,1-dichloroethylene, methylene chloride, 1,1-dichloroethane and benzene. TCE exceeded the GWQS of 1.0 ug/L at eight monitoring wells in Areas 1, 2, 3, and 7, with concentrations ranging from 3.0 ug/L (MW-9) to 380 ug/L (MW-4). 1,1-Dichloroethylene exceeded the NJDEP GWQS of 2.0 ug/L in Area 1 at MW-4 (26.0 ug/L). Methylene Chloride exceeded the GWQS of 2.0 ug/L in Area 1 at MW-8 (2.0 ug/L). 1,1-Dichloroethane exceeded the GWQS of 70.0 ug/L at MW-4 (220 ug/L). Trans-1,2-Dichloroethylene was detected five well locations below the NJDEP GWQS of 100 ug/L, ranging in concentration from 4.0 ug/L (MW-9) to 18.0 ug/L (MW-13). Benzene was detected at MW-4 (16.0 ug/L), exceeding the GWQS of 1.0 ug/L.

Priority pollutant metals (total) were analyzed site wide and were typically present at concentrations above MDL's, but below NJDEP GWQS. Total metals analyses detected arsenic, cadmium, chromium and lead. The dissolved metal analysis for groundwater typically yielded results below detection limits. General indicator parameters such as calcium, sodium, potassium, magnesium, sulfate, nitrate, and chloride were consistently above MDL'S. Explosive compounds were detected in three of the 30 monitoring wells, including MW-16 (1.54 mg/L - Tetryl), MW-17 (3.93 ug/L - 1,3,5-TNB), and MW-19 (1.43 mg/L - HMX). These compounds were detected in monitoring wells downgradient of Area 4.

5.1.2 Dames & Moore Sampling Results

During July and August 1992, Dames & Moore sampled monitoring wells under the Phase 1 RI. A total of 27 monitoring wells were installed as part of the Dames & Moore Phase 1 investigation. Groundwater samples were collected by Dames & Moore from the 27 newly installed wells and existing OBG monitoring wells. Groundwater samples were analyzed for VOC, BNA, total metals, pesticides and explosives, with select locations testing both total and dissolved metals (Table 5-2).

The results of the groundwater investigation indicated VOC contamination at concentrations exceeding NJDEP GWQS. Total VOCs detected in monitoring wells with GWQS exceedances were: MW-7 (5.2 ug/L) in Area 1, MW-8 (137.3 ug/L) in Area 1, MW-9 (22 ug/L) in Area 1, MW-11 (103 ug/L) in Area 7, MW-13 (468 ug/L) in Area 2, MW-14 (5.4 ug/L) in Area 2, MW-31 (130 ug/L) in Area 1, MW-40 (16.8 ug/L) upgradient of Area 2, MW-46A (188 ug/L) in Area 10, MW-47A (264.2 ug/L) in Area 19, MW-48B (30.0 ug/L) in Area 9, MW-52B (64.7 ug/L) in Area 16, MW-58 (249 ug/L) in Area 3, MW-59 (622 ug/L) in Area 7, MW-62 (38.4 ug/L) in Area 6, and MW-63 (34.0 ug/L) in Area 12.

The primary VOC contaminants detected that exceeded the NJDEP GQWS during the Dames & Moore groundwater investigation were TCE, 1,2-dichloroethane, bromodichloromethane, 1,1-dichloroethane, total-1,2-dichloroethylene, benzene, chlorobenzene, chloroform, chloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethane, and vinyl chloride. TCE exceeded the NJDEP GWQS of 1.0 ug/L in 12 of 52 wells within Areas 1, 2, 7, 9, 10 and 19 ranging in concentration from 5.2 ug/L (MW-7) to 310 ug/L (MW-13). 1,2 - Dichloroethane exceeded the GWQS of 2.0 ug/L in Area 7 at MW-59 (46.0 ug/L) and at MW-11 (12 ug/L). Bromodichlormethane exceeded the GWQS of 1.0 ug/L in Area 6 at MW-62 (3.4 ug/L). 1,1-Dichloroethane exceeded the GWQS of 70.0 ug/L in Area 7 at MW-59 (170 ug/L). Total-1,2-Dichloroethylene exceeded the GWQS of 10.0 ug/L at seven of 52 well locations, ranging from 4.3 to 160 ug/L. Benzene exceeded the GWQS of 1.0 ug/L at four of 52 locations, ranging from 3.3 ug/L (MW-59) to 14.0 ug/L (MW-46A). Chlorobenzene exceeded the GWQS of 4.0 ug/L in Area 7 at MW-59 (270 ug/L). Chloroform exceeded the GWQS of 6.0 ug/L in two of 52 locations with a concentration range of 19.0 ug/L (MW-63) to 35.0 ug/L (MW-62). Chloroethane was detected in Area 7 at MW-59 (85.0 ug/L). Vinyl chloride exceeded the GWQS of 5.0 ug/L at 3 of 52 locations, with a concentration range of 11.0 ug/L (MW-11) to 18.0 ug/L (MW-46A).

Metals analytical results indicated that four compounds exceeded the NJDEP GWQS (Table 5-2). Arsenic exceeded the NJDEP GWQS of 8.0 ug/L at 18 of 52 locations, with concentrations ranging from 8.7 ug/L (MW-13) to 173 ug/L (MW-50). Lead exceeded the NJDEP GWQS of 10.0 ug/L at ten locations, with concentrations ranging from 10.9 ug/L (MW-62) to 199 ug/L (MW-31). Cadmium exceeded the NJDEP GWQS of 4.0 ug/L at six wells, with concentrations that ranged from 5.0 ug/L (MW-42A) to 23.0 ug/L (MW-47A). Chromium exceeded the NJDEP GWQS of 100 ug/L at MW-54 (131 ug/L).

Explosive compounds were detected in 14 of 27 monitoring wells. Explosives were detected at MW-15 (0.695 mg/L 1-3, dinitrobenzene), MW-16 (22.1 ug/L nitroglycerin), MW-17 (4.77 ug/L 2,4 dinitrotoluene), MW-18 (0.735 ug/L 1,3-dinitrobenzene, MW-21 (12.8 ug/L HMX, 1.54 ug/L RDX and 0.551 ug/L 1,3,5-trinitrobenzene), MW-28 (12.7 ug/L nitroglycerin), MW-30 (25.4 ug/L PETN), MW-45 (0.789 ug/L 1,3-dinitrobenzene), MW-47A (0.368 ug/L 1,3,5-trinitrobenzene), MW- 52B (3.66 ug/L HMX and 13.2 ug/L nitroglycerin), MW-60 (0.811 ug/L 1,3-dinotrobenzene and 22.6 ug/L PETN), and MW-63 (1.15 ug/L RDX).

Thiodiglycol was detected at only MW-19 (22.3 ug/L).

5.2 SUMMARY OF GROUNDWATER QUALITY DETERMINED DURING THE PHASE 2 RI

5.2.1 Results of Shallow Groundwater Screening Investigation

As part of the Phase 2 RI for expedited sites, WESTON carried out a shallow groundwater screening (SGWS) survey during April and May 1994. The primary objective of the program was to sample the first encountered groundwater over a wide area of the former Arsenal so that areas of shallow groundwater containing VOCs could be delineated as an aid in performing the Phase 2 RI monitoring well sampling program. The SGWS was implemented using the Geoprobe® system. The complete SGWS program results were reported previously in the Work Plan Addendum dated December 1994.

Figure 5-1 shows the estimated areal extent of VOC contamination in shallow or first encountered groundwater, based on the groundwater quality data collected during the SGWS program. The apparent VOC plumes are differentiated between areas which have halogenated compounds and areas having aromatic compounds. The outer edges of the plumes were estimated by sample locations where VOCs were not detected. There were also nine isolated SGWS "hits" (SGW-5, 6, 7, 9, 48, 56, 64, 91, and 106) shown on Figure 5-1. In five (SGW-5, 6, 9, 48, and 91) of the nine locations, a single aromatic compound was detected just above the detection limit. Three of the four remaining locations contained halogenated VOCs, with SGW-106 containing 11 ug/L of aromatic compounds. These isolated point "hits" all have low VOC concentrations and do not appear to be associated with any other contamination.

The most prevalent VOCs detected during the SGWS program were the halogenated compounds. The most prevalent halogenated compound detected was TCE. The highest concentration of

TCE was detected at SGW-94 (8,000 ug/L). All of the seven apparent plumes contain halogenated compounds. Aromatic compounds are present in a portion of three of the apparent plumes. A discussion of the aerial extent of each previously estimated VOC plume is presented below.

5.2.1.1 Estimated VOC Plume Areas

Based on the SGWS data, several VOC plumes were identified in proximity to potential current or historical known source areas. Three rounds of groundwater measurements during the Phase 2 RI have confirmed the LS (overburden) and bedrock aquifers flow direction is generally southeasterly towards the Raritan River, supporting the general assumptions from the SGWS program that potential source areas were in the northern and northwestern portions of the estimated VOC plumes. Some of the potential source areas were previously identified as AOCs within the Phase 2 RI Work Plans.

SGWS AOC 1 - Vicinity of Raritan Plaza I and II

The location of the former Edison Township sewage treatment plant near the entrance to the Raritan Center is believed to be a potential source area. This area is located upgradient of a halogenated VOC plume. During the construction of the Holiday Inn, soil contamination was reportedly encountered and remediated in this area.

SGWS AOC 2 - Area 18C Building 256

The northeast corner of Area 18C, near the northeast corner of Building 256, is believed to be a potential source area. This is the upgradient portion of a relatively large halogenated VOC plume extending toward the southeast. This halogenated VOC plume was previously detected in monitoring wells located within the Building 151 area (a Phase 2 RI AOC).

SGWS AOC 3 - Owens-Illinois

A location near the rear of the Owens-Illinois building is believed to be a potential source area. This is the upgradient portion of a relatively small halogenated VOC plume extending to the southeast. Eight soil borings were drilled and a monitoring well installed within the location of the former aboveground tank farm on the Owens-Illinois property as part of the Phase 2 RI. The sampling results for the soil borings are presented in the Owens-Illinois Soils ROI report.

SGWS AOC 4 - Area 18A

The location of the Former GSA/US Army Pond Area (Area 18A) is believed to be one of the potential source areas. This is the upgradient portion of a relatively large halogenated VOC plume extending toward the southeast, previously identified in monitoring wells located within Areas 1, 10, 18A, and 18B.

SGWS AOC 5 - Area 10 Tennis Court Area

The general tennis court area located in the northeast corner of Thomas Edison County Park is believed to be a potential source area. This is the upgradient portion of a relatively small halogenated VOC plume previously undetected. Previous surface soil sampling conducted in this area by Dames & Moore did not detect organic soil contamination above either the NJDEP RDCSCC or IGWSCC. Three soil borings were drilled within this general area during the Phase 2 RI, as presented in the draft Report of Investigation for Area 10 dated August 1994. Sampling at these borings did not detect any VOCs.

SGWS AOC 6 - Area 19

A location in the northwestern portion of Area 19 is believed to be a potential source area. This is the upgradient portion of a relatively large halogenated VOC plume extending to the southeast. In addition, elevated halogenated VOCs were also detected at two locations near the Exposition Center, near the downgradient portion of this apparent plume.

Previous Dames & Moore and OBG investigations in this area did not indicate organic contaminates above either the NJDEP RDCSCC or IGWSCC. However, OBG detected low concentrations of toluene in several deep soil samples and a soil gas survey performed by Dames & Moore during the Phase 1 RI detected low concentrations of VOCs (TCE and BTEX) in the soil gas.

SGWS AOC 7 - Area 7

The location of a former aboveground storage tank and historical sump on the north side of the Area 7 site are believed to be potential source areas. The historical sump located adjacent to former Building S-810, had been previously backfilled with soil and was suspected to be heavily contaminated. This 30 by 15 foot area was fenced off and recommended for "Non-Use" during the LEAD investigation. This is the upgradient portion of a relatively small halogenated and aromatic VOC plume extending to the southeast.

Sampling of the historical sump area by OBG did not indicate any contaminants of concern. The results of the Dames & Moore soil gas survey indicated that VOC may be present in the subsurface. A subsequent soil sample location (B7-1) contained elevated concentrations of VOC. Soil in this area was also sampled during the Phase 2 RI.

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5.2.2 Round 1 Groundwater Sampling Analytical Results

A total of 119 existing and newly installed monitoring wells were sampled during the Round 1 groundwater sampling event (November 1994). Results exceeding NJDEP GWQS for these samples are presented in Tables 5-3 to 5-7, and a complete data summary is provided in Appendix I. In general, VOCs, SVOCs, pesticides and metals exceeding NJDEP GWQS were found only in overburden wells. Bedrock wells did detect some metals contaminants exceeding GWQS, but the presence of these compounds may be attributed to natural conditions. The dominant groundwater contaminants of concern, based on Class IIA GWQS, were VOCs and metals. A summary of the Round 1 groundwater sampling analytical results and a comparison to NJDEP GWQS are provided below.

5.2.2.1 VOCs in Groundwater

USEPA TCL VOCs were detected at concentrations exceeding the NJDEP Class IIA GWQS for a total of eight compounds in 25 of 119 wells. Based upon frequency of detection, the main VOC contaminants of concern were TCE, PCE and total 1,2-dichloroethene. Other VOCs detected at levels exceeding NJDEP GWQS include benzene, 1,2-dichloroethane, chlorobenzene, vinyl chloride and dichlorobromomethane. VOC exceedances of the NJDEP GWQS were generally detected in the northern and north-central portions of the former Arsenal. In the southern portion of the site (south of Areas 9 and 19), VOCs were detected but did not exceed the GWQS, except at the MW-91 cluster within Area 16. The Round 1 results of the VOC analyses are presented in Table 5-3. VOCs which exceeded GWQS included the following:

- Trichloroethylene (TCE) was detected at concentrations exceeding the NJDEP GWQS of 1.0 ug/L at 23 of 119 groundwater sampling locations (Figure 5-2). TCE exceeded the GWQS in overburden wells at background locations MW-103A (7.0 ug/L) and MW-105A (4.0 ug/L); in Area 1 at MW-7 (5.0 ug/L), MW-8 (82.0 ug/L), MW-9 (2.0 ug/L) and MW-31 (48.0 ug/L); in Area 2 at MW-13 (300 ug/L); in Area 3 at MW-14 (7.0 ug/L) and MW-58 (110 ug/L); in Area 7 at MW-11 (9.0 ug/L) ad MW-59 (13.0 ug/L); in Area 9 at MW-47A (30.0 ug/L), MW-48A (8.0 ug/L), MW-48B (24.0 ug/L) and MW-80A (11.0 ug/L); in Area 10 at MW-46A (27.0 ug/L); in Area 15 at MW-84A (8.0 ug/L); in Area 16 at MW-91A (28 ug/L); in Area 18C at MW-88A (4.0 ug/L); in Area 18G at MW-87A (7.0 ug/L); and in the vicinity of Building 151 at MW-81A (590 ug/L), MW-SA5 (240 mg/L) and MW-SPCI4 (150 ug/L). TCE was not detected in any other wells during Round 1.

- Total-1,2-dichloroethene exceeded the NJDEP GWQS of 10.0 ug/L at 15 of 119 well locations (Figure 5-3). 1,2-Dichloroethene exceeded the GWQS in overburden wells at background location MW-103A (40 ug/L); in Area 1 at MW-8 (14.0 ug/L) and MW-31 (13.0); in Area 2 at MW-13 (180 ug/L); in Area 7 at MW-11 (16 ug/L) and MW-59 (21 ug/L); in Area 9 at MW-47A (110 ug/L); in Area 10 at MW-46A (120 ug/L); in Area

15 at MW-84A (18.0 ug/L); in Area 16 at MW-92B (13.0 ug/L); in Area 18A at MW-EPA2A (160 ug/L); in Area 18C at MW-88A (17.0 ug/L); and in the vicinity of Building 151 at MW-81A (260 ug/L), MW-SA5 (220 ug/L) and MW-SPI4 (36.0 ug/L). In addition, total-1,2-dichloroethene was detected below the GWQS at eight overburden locations at concentrations ranging from 1.0-9.0 ug/L.

- Tetrachloroethylene (PCE) exceeded the NJDEP GWQS of 1.0 ug/L at nine of 119 well locations (Figure 5-4). PCE exceeded the GWQS in overburden wells at background location MW-103A (8.0 ug/L); in Area 3 at MW-58 (13.0 ug/L); in Area 7 at MW-11 (3.0 ug/L); in Area 9 at MW-48A (16.0 ug/L) and MW-48B (3.0 ug/L); in Area 18G at MW-87A (2.0 ug/L); and in the vicinity of Building 151 at MW-81A (31.0J ug/L); MW-SA5 (22.0 ug/L) and MW-SPCI4 (22.0 ug/L). PCE was not detected in any other wells during Round 1.

- Vinyl Chloride exceeded the NJDEP GWQS of 5.0 ug/L at five of 119 well locations (Figure 5-5). Vinyl chloride exceeded the GWQS in overburden wells in Area 7 at MW-59 (15.0 ug/L); in Area 10 at MW-46A (13.0 ug/L); in Area 18A at MW-EPA2A (38 ug/L); and in the vicinity of Building 151 at MW-81A (10.0 ug/L) and MW-SA5 (16.0 ug//l). In addition, vinyl chloride was detected below the GWQS at four overburden locations at concentrations ranging from 2-4 ug/L.

- Benzene was detected at concentrations exceeding the NJDEP GWQS of 1.0 ug/L at five of 119 well locations (Figure 5-6). Benzene exceeded the GWQS in overburden wells in Area 2 at MW-13 (72.0 ug/L); Area 7 at MW-11 (4.0 ug/L) and MW-59 (50.0 ug/L); Area 9 at MW-47A (7.0 ug/L); and Area 10 at MW-46A (1.8 ug/L). Benzene was not detected at any other wells during Round 1.

- Chlorobenzene exceeded the NJDEP GWQS of 50.0 ug/L at two of 119 well locations (Figure 5-7). Chlorobenzene exceeded the GWQS in overburden wells in Area 7 at MW-11 (82.0 ug/L) and MW-59 (450 ug/L). Chlorobenzene was not detected at any other wells during Round 1.

- 1,2-Dichloroethane exceeded the NJDEP GWQS of 2.0 ug/L in two of 119 locations (Figure 5-8). Both sample exceedances were detected at Area 7 in overburden wells, ranging from 14.0 ug/L at MW-11 to 16.0 ug/L at MW-59. This compound was not detected at any other wells during Round 1.

- Dichlorobromomethane exceeded the NJDEP GWQS of 1.0 ug/L at one of 119 monitoring well locations (Figure 5-9). The compound was detected at Area 18G overburden well MW-87A at a concentration of 2.0 ug/L. This compound was not detected at any other wells during Round 1.

Other targeted VOCs detected at concentrations below the NJDEP GWQS included 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, acetone, carbon disulfide, chloroform, ethyl benzene, toluene, and total xylenes. The majority of the VOCs TICs detected included substituted benzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1-chloro-2-methylbenzene, diethylether, chlorinated hydrocarbons, cyclic hydrocarbons, unknown hydrocarbons and unknowns. The TICs ranged in concentration from non-detect to 355 ug/L. Complete VOC analytical results, including the forward library search, are presented in Appendix I.

5.2.2.2 SVOCs in Groundwater

The only USEPA TCL SVOC detected at concentrations exceeding a NJDEP Class IIA groundwater standard was bis(2-ethylhexyl)phthalate. The compound was present in concentrations exceeding the NJDEP GWQS of 30.0 ug/L at two of 119 wells, including bedrock well MW-90C (72.0 ug/L) in Area 16 and overburden well MW-67 (140 ug/L) in Area 5. In addition, bis(2-ethylhexyl)phthalate was detected at levels below the GWQS at eight locations in overburden and bedrock wells in Areas 1, 6 and background locations at concentrations ranging from 2.0-28 ug/L. Table 5-4 summarizes the analytical results for bis(2-ethylhexyl)phthalate for all Round 1 wells.

Other targeted SVOCs detected at concentrations below the NJDEP GWQS included 2-methylnapthalene, acenaphthene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(g,h,i)perylene, chrysene, di-n-butyl phthalate, dibenzo(a,h)anthracene, naphthalene and indeno(1,2,3-cd)pyrene. The majority of the SVOCs TICs detected include chlorobenzene isomer, trichloroethylene, tetrachloroethylene and chloromethylbenzene. Complete SVOC analytical results, including the forward library search, are presented in Appendix I.

5.2.2.3 Metals and Cyanide in Groundwater

Eleven USEPA TAL/PPM metals were detected at concentrations exceeding the NJDEP Class IIA GWQS at 63 of 119 wells (Table 5-5), including 54 overburden wells and 9 bedrock wells. Metal compounds that exceeded the NJDEP GWQS were predominantly detected in the southern portion of the former Arsenal and included aluminum, antimony, arsenic, cadmium, chromium, iron, lead, manganese, mercury, nickel and sodium. Metals exceeding the GWQS in bedrock wells were primarily iron, manganese and sodium. Individual metal exceedances of the GWQS are presented below.

- Arsenic exceeded the NJDEP GWQS of 8.0 ug/L at 23 of 119 wells, predominantly within Areas 4, 5, 6A, 6B, 11, 12, 14 and 16 (Figure 5-10). Arsenic concentrations exceeding the GWQS in overburden wells ranged from 8.2 ug/L (MW-16) to 398 ug/L (MW-50). Arsenic did not exceed the GWQS in the bedrock wells. In addition, arsenic was detected in 5 bedrock wells (2.0-5.2 ug/L) and 27 overburden wells (1.8-7.6 ug/L)

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at concentrations below the NJDEP GWQS. Arsenic was detected in background bedrock well locations MW-103C (3.10 ug/L) and MW-104C (5.2 ug/L).

- Iron exceeded the NJDEP GWQS of 300 ug/L at 35 of 41 wells within Areas 1, 3, 4, 5, 6, 6A, 6B, 7, 8, 9, 10, 11, 12, 14, 15, 16, 18A, 19 and background locations (Figure 5-11). Iron concentrations exceeded the GWQS in 26 overburden wells (539-159,000 ug/L) and in 9 bedrock wells (478-8,040 ug/L). Iron was detected at concentrations below the GWQS in overburden well MW-57 (234 ug/L) in Area 10.

- Aluminum exceeded the NJDEP GWQS of 200 ug/L at 24 of 41 wells within Areas 1, 3, 4, 5, 6, 6A, 6B, 7, 10, 11, 14, 16, 19, and Owens-Illinois (Figure 5-12). Aluminum concentrations exceeding the GWQS ranged from 214 mg/L (MW-21) to 76,900 ug/L (MW-100A) in overburden wells and from 240 ug/L (MW-103C background) to 2,050 ug/L (MW-90C) in bedrock wells. Aluminum was detected at concentrations below the NJDEP GWQS at one overburden and two bedrock locations, ranging from 33.9 to 132 ug/L.

- Manganese exceeded the NJDEP GWQS of 50.0 ug/L at 36 of 41 wells (Figure 5-13). Manganese exceedances of the GWQS were detected in 27 overburden and 8 bedrock wells within Areas 1, 3, 4, 5, 6, 6A, 6B, 7, 9, 10, 11, 12, 14, 15, 16, 18A, 19, Building 151, Owens-Illinois and background locations, with concentrations ranging from 55.0 ug/L to 8,000 ug/L. Manganese was detected at concentrations below the NJDEP GWQS at two overburden wells and one bedrock well within Areas 3, 7 and 14, at concentrations ranging from 46.5-49.9 ug/L.

- Sodium exceeded the NJDEP GWQS of 50,000 ug/L at 21 of 41 wells (Figure 5-14). Sodium exceedances of the GWQS were detected in 17 overburden wells and 4 bedrock wells within Areas 3, 4, 6, 6A, 6B, 8, 9, 11, 12, and 14, ranging from 52,700 ug/L to 5,770,000 ug/L. Sodium was detected at concentration below the NJDEP GWQS at 12 overburden and 6 bedrock well locations in Areas 1, 3, 5, 7, 9, 10, 15, 18A, 19, Building 151, Owens-Illinois and background locations, ranging from 2,540-49,400 ug/L.

- Lead exceeded the NJDEP GWQS of 10.0 ug/L at seven of 119 wells (Figure 5-15). Lead exceedances of the GWQS were detected in overburden wells within Areas 4, 10, 11, 14, 16 and XHW at concentrations ranging from 10.4 to 239 ug/L. Lead was detected at concentrations below the NJDEP GWQS in 15 overburden and two bedrock wells within Areas 1, 4, 6A, 9, 14 and Building 151 at concentrations ranging from 1.8-7.1 ug/L.

- Antimony exceeded the NJDEP GWQS of 20.0 ug/L at three of 119 wells (Figure 5-16). Antimony concentrations exceeding the GWQS ranged from 27.2 ug/L to 39.2 ug/L.

Antimony was detected at a concentration below the NJDEP GWQS in Area 14 overburden well MW-50 (13.0 ug/L).

- Nickel exceeded the NJDEP GWQS of 100 ug/L at two of 119 wells (Figure 5-17). Nickel exceeded the GWQS in Area 9 at MW-47A (151 ug/L) and in Area 11 at MW-100A (164 ug/L). Nickel was detected at concentrations below the NJDEP GWQS at 35 overburden and 2 bedrock wells within Areas 1, 3, 4, 5, 6, 6A, 7, 9, 10, 12, 14, 15, 19, Building 151, Building 118, background locations and Area X, H and W ranging from 13.2-75.9 ug/L.

- Cadmium was detected at a concentration equal to the NJDEP GWQS of 4.0 ug/L at one of 119 wells: overburden well MW-66 in Area 5 (Figure 5-18). Cadmium was detected at concentrations below the NJDEP GWQS at 15 overburden and 3 bedrock wells within Areas 3, 5, 6, 9, 10, 11, 14, 16 and Areas X, H and W at concentrations ranging from 1.0-3.2 ug/L.

- Chromium exceeded the NJDEP GWQS of 100 ug/L at one of 119 wells (Figure 5-19). Overburden well MW-100A within Area 11 contained chromium at a concentration of 271 ug/L. Chromium was detected at concentrations below the NJDEP GWQS in 22 overburden wells and four bedrock wells within Areas 1, 4, 6, 6A, 9, 10, 11, 14, 16, 19, Owens-Illinois, Building 118 and Areas X, H and W at concentrations ranging from 7.0-83.2 ug/L.

- Mercury exceeded the NJDEP GWQS of 2.0 ug/L at one of 119 wells (Figure 5-20). Area 15 overburden well MW-85A contained mercury at a concentration of 3.0 ug/L. Mercury was detected at concentrations below the NJDEP GWQS at six overburden wells within Areas 7, 12, 14, 15 and X, H and W, ranging from 0.20-0.29 ug/L.

  Other metals detected in groundwater at concentrations below GWQS included barium, beryllium, calcium, cobalt, copper, magnesium, potassium, selenium, silver, thallium, vanadium and zinc.

  Cyanide was not detected in any of the 119 wells sampled during Round 1.

Complete analytical results for all metals and cyanide samples are presented in Appendix I.

5.2.2.4 Pesticides/PCBs in Groundwater

One USEPA TCL Pesticide was detected at a concentration exceeding the NJDEP Class IIA standards in one of 119 monitoring wells (Figure 5-21). Aldrin was detected at a concentration exceeding the NJDEP GWQS of 0.04 ug/L at overburden well MW-100A (0.042 ug/L J) in

Area 11 (Table 5-6). The detection limit for aldrin for most samples exceeded the GWQS of 0.04 ug/L, but met the approved CDAP PQL of 0.05 ug/L.

All other targeted pesticides were not detected. Complete analytical results for all pesticide samples are presented in Appendix I.

USEPA TCL PCBs were not detected in any of the 119 wells sampled. Complete analytical results for TCL PCB samples are presented in Appendix I.

5.2.2.5 Dioxin and Furans in Groundwater

USEPA TCL Dioxin and Furans were not detected in any of the 6 wells sampled. The complete analytical results for TCL Dioxin and Furans samples are presented in Appendix I.

5.2.2.6 Thiodiglycol in Groundwater

Thiodiglycol was not detected in any of the 38 wells sampled. The complete analytical results for thiodiglycol samples are presented in Appendix I.

5.2.2.7 Explosives in Groundwater

Explosives were detected at 2 of the 119 wells sampled. Total amino DNT's (22.0 ug/L), 2,4-dinitrotoluene (3.8 ug/L) and 2,6-dinitrotoluene (0.53 ug/L) were detected at Area 4 overburden well MW-17. Total amino-DNT's (5.7 ug/L) were also detected at Area 4 overburden well MW-42A. The NJDEP GWQS for total 2,4-dinitrotoluene and 2,6-dinitrotoluene is 10 ug/L. There are no GWQS for amino-DNT compounds. The complete results for Method 8330 explosives analyses are presented in Appendix I.

5.2.2.8 Physical Properties/Characteristics of Groundwater

A total of 26 groundwater samples were collected and analyzed for standard groundwater parameters such as TDS, hardness and oil and grease (Appendix I). In addition, field water quality tests were performed on the groundwater that was developed, purged and sampled. The field tests performed were pH, temperature, conductivity, and salinity, eH, dissolved oxygen (DO) and turbidity. The results of field testing were presented in Section 4.0. The results of the Round 1 testing for general water quality parameters included the following:

- Hardness exceeded the NJDEP GWQS standard of 250 mg/L at 7 overburden and 3 bedrock wells out of the 26 groundwater locations sampled. Overburden well exceedances ranged from 320-4,080 mg/L and bedrock well exceedances ranged from 4,730-7,760 mg/L. Hardness levels in bedrock and overburden wells which did not exceed the GWQS ranged from 33.8-242 mg/L.

- Total Dissolved Solids (TDS) exceeded the NJDEP GWQS standard of 500,000 ug/L at three bedrock and nine overburden wells out of the 26 groundwater locations sampled (Table 5-7). Most TDS exceedances were encountered in the southern portion of the site. Overburden well exceedances ranged from 620,000-19,000,000 ug/L and bedrock well exceedances ranged form 12,000,000-19,000,000 ug/L. TDS levels in bedrock and overburden wells which did not exceed the GWQS ranged from 78,000-490,000 ug/L.

- Oil and grease were not detected in any of the 27 wells sampled.

5.2.3 Round 2 Groundwater Analytical Results

A total of 6 Round 1 wells were resampled (and MW-40) during the Round 2 groundwater sampling event (December 1994). The analytical results exceeding NJDEP GWQS for these samples are presented in Tables 5-8 to 5-11, and a complete summary of analytical results is provided in Appendix I. The results for the Round 2 sampling confirmed the Round 1 results for all 63 newly installed wells. Four previously installed OBG and Dames & Moore overburden wells were resampled during Round 2. A summary of the Round 2 sampling results is provided below.

5.2.3.1 VOCs in Groundwater

USEPA TCL VOCs were detected at concentrations exceeding the NJDEP Class IIA GWQS groundwater standards in 9 of 67 wells. The VOCs exceeding the GWQS were TCE, PCE and 1,2 dichloroethene. These compounds were detected only in overburden wells. The results of the VOCs analysis are presented in Table 5-8. The VOCs which exceeded GWQS are presented below:

- TCE was detected at concentrations exceeding the NJDEP GWQS of 1.0 ug/L at eight of 67 groundwater sampling locations (Figure 5-22). TCE exceeded the GWQS in overburden wells in Area 9 at MW-80A (12.0 ug/L); in Area 15 at MW-84A (8.0 ug/L); in Area 16 at MW-91A (32.0 ug/L); in Area 18C at MW-88A (3.0 ug/L); in Area 18D at MW-87A (3.0 ug/L); and at background well locations MW-40 (8.0 ug/L), MW-103A (8.0 ug/L) and MW-105A (3.0 ug/L).. TCE was not detected in any other well during Round 2 sampling.

- Total-1,2-Dichloroethene exceeded the NJDEP GWQS of 10.0 ug/L at four of 67 groundwater sampling locations (Figure 5-23). This compound exceeded the GWQS in overburden wells in Area 15 at MW-84A (22.0 ug/L); in Area 16 at MW-92B (19.0 ug/L) and at background locations MW-40 (11.0 ug/L) and MW-103A (48.0 ug/L). Total-1,2-Dichloroethene was detected at concentrations less than or equal to the GWQS in Area 6 at MW-96A (2.0 ug/L); in Area 16 at MW-91A (32.0 ug/.l); and in Area 18G at MW-88A (10.0 ug/L).

- PCE exceeded the NJDEP GWQS of 1.0 ug/L at three of 67 groundwater sampling locations (Figure 5-24). PCE exceeded the GWQS in overburden wells in Area 18G at MW-87A (2.0 ug/L) and background wells MW-40(3.0 ug/L) and MW-103A (8.0 ug/L). This compound was not detected in any other wells during Round 2.

Other target VOCs detected at 5 of 67 wells at concentrations below the NJDEP GWQS included acetone, ethyl benzene, toluene, and total xylenes. To aid in the comparison of Round 1 and Round 2 VOC sampling, Table 5-8 presents Round 2 results for all VOCs which exceeded the GWQS during Round 1 sampling. Complete results for VOC analyses are presented in Appendix I.

5.2.3.2 SVOCs in Groundwater

USEPA TCL SVOC's were not detected at concentrations exceeding the NJDEP GWQS at any of the Round 2 wells. Ten SVOCs were detected at 12 wells at concentrations below the GWQS. To aid in the comparison of Round 1 and Round 2 SVOC sampling results, Table 5-9 presents Round 2 results for bis(2-ethylhexyl) phthalate, the only SVOC which exceeded GWQS during Round 1. Complete results for SVOC analyses are presented in Appendix I.

5.2.3.3 Metals and Cyanide in Groundwater

Seven USEPA TAL/PPM metals were detected at concentrations exceeding the NJDEP GWQS at 25 of 67 wells (Table 5-10), including 17 overburden wells and 8 bedrock wells. Metals which exceeded the GWQS included aluminum, arsenic, cadmium, iron, manganese, nickel and sodium. As in Round 1, metals exceeding the GWQS in bedrock wells were primarily iron, manganese and sodium. Individual metal exceedances of the GWQS are presented below.

- Manganese exceeded the NJDEP GWQS of 50.0 ug/L at 18 of 67 locations (Figure 5-25). Manganese exceeded the GWQS in Areas 4, 5, 6, 6B, 9, 11, 14, 16, 18A, OI and background locations in 10 overburden wells (127-1,460 ug/L) and 8 bedrock wells (54.9-5,770 ug/L). Manganese was not detected at concentrations below the NJDEP GWQS during Round 2.

- Sodium exceeded the NJDEP GWQS of 50,000 ug/L at 12 of 67 locations (Figure 5-26). Sodium exceeded the GWQS in Areas 4, 6, 6A, 6B, 11, 14 and 18A at 8 overburden wells (144,000-3,900,000 ug/L) and 4 bedrock wells (123,000-3,820,000 ug/L). Sodium was detected at concentration below the NJDEP GWQS at 3 overburden (2,690-46,700 ug/L) and 5 bedrock locations (17,800-123,000 ug/L) within Areas 1, 5, 7, 9, 15, OI and background locations.

- Iron exceeded the NJDEP GWQS of 300 ug/L at 15 of 67 locations (Figure 5-27). Iron exceeded the GWQS in Areas 1, 4, 6A, 6B, 8, 9, 11, 14, 16, 18A and OI in 9 overburden wells (4,010-28,900) and 6 bedrock wells (500-13,500 ug/L). Iron was detected at a concentration below the NJDEP GWQS in Area 5 at MW-66 (106 ug/L).

- Aluminum exceeded the NJDEP GWQS of 200 ug/L at 12 of 67 locations, including wells within Areas 4, 5, 6, 6A, 6B, 8, 11, and OI (Figure 5-28). Aluminum concentrations exceeded GWQS in 10 overburden wells (226-6,010 ug/L) and 2 bedrock wells (554-7,850 ug/L). Aluminum was detected at concentrations below the GWQS in Areas 1, 18A and one background location in one overburden and two bedrock wells ranging from 29.9-120 ug/L.

- Arsenic exceeded the NJDEP GWQS of 8.0 ug/L at nine of 67 locations, including wells within Areas 4, 6, 6A, 6B, 11 and 16 (Figure 5-29). Arsenic concentrations exceeded the GWQS at 8 overburden wells ranging from 11.1 ug/L (MW-76B) to 22.5 ug/L (MW-97A). In addition, arsenic was detected at concentrations below the NJDEP GWQS in 17 overburden wells (1.8-6.5 ug/L) and 6 bedrock wells (1.8-3.8 ug/L) within Areas 1, 4, 5, 6, 8, 9, 14, 16, 19, background and Areas X,H and W.

- Cadmium exceeded the NJDEP GWQS of 4.0 ug/L at two of 67 locations (Figure 5-30). Cadmium exceeded the GWQS in Area 5 overburden wells MW-66 (4.3 ug/L) and MW-67 (5.0 ug/L). Cadmium was detected at concentrations below the NJDEP GWQS in Areas 1, 4, 5, 6, 14, and 16 at nine overburden well locations ranging from 1.2-3.0 ug/L.

- As shown in Figure 5-31, nickel exceeded the NJDEP GWQS of 100 ug/L at Area 6 overburden well MW-96A (172 ug/L). Nickel was detected at concentrations below the NJDEP GWQS at 9 overburden wells (14.4-75.0 ug/L) and 2 bedrock wells (13.10-21.30 ug/L).

Other metals detected in groundwater at concentrations below GWQS included barium, beryllium, calcium, chromium, cobalt, copper, lead, magnesium, mercury, potassium, selenium, silver, thallium, vanadium and zinc.

Cyanide was not detected in any of the 67 wells sampled during Round 2.

To aid in the comparison of Round 1 and Round 2 metals sampling results, Table 5-10 presents Round 2 results for the additional metals which exceeded GWQS during Round 1. Complete analytical results for all metals and cyanide samples are presented in Appendix I.

5.2.3.4 Pesticides/PCBs in Groundwater

USEPA TCL Pesticide and PCBs were not detected in any of the 67 wells sampled. To aid in the comparison of Round 1 and Round 2 pesticide sampling results, Table 5-11 presents the

Round 2 results for aldrin, the only compound detected during Round 1 sampling. Complete analytical results for all pesticide/PCB samples are presented in Appendix I.

5.2.3.5 Dioxin/Furans in Groundwater

USEPA TCL Dioxin and Furans were not detected in either of the 2 wells sampled. The results for all TCL Dioxin and Furan samples are presented in Appendix I.

5.2.3.6 Thiodiglycol in Groundwater

Thiodiglycol was not detected in any of the 21 locations sampled. Complete results for all thiodiglycol samples are presented in Appendix I.

5.2.3.7 Explosives in Groundwater

Explosives were not detected in any of the 67 locations sampled. Complete results for Method 8330 sample analyses are presented in Appendix I.

5.2.3.8 Physical Properties/Characteristics of Groundwater

TDS, hardness, and oil and grease were only collected during Round 1, based on the work plan. However, water quality tests were performed on the groundwater that was developed, purged and sampled. Additional tests performed were pH, temperature, conductivity, salinity, eH, dissolved Oxygen (DO) and turbidity, as presented in Section 3.0.

5.4 QA/QC REVIEW OF LABORATORY RESULTS

A QC summary for Phase 2 RI groundwater data is presented in Appendix H. The QC review summarizes data versus CDAP compliance.

All analysis holding times were met as defined in Table 4-1 of the July 1995 CDAP Addendum with the following exceptions:

- Thiodiglycol: A total of 14 samples were analyzed one day past the hold time of 14 days. Two samples were analyzed two days past the holding time of 14 days. Four samples were analyzed three days past the holding time of 14 days. The holding time of 14 days is not an EPA established holding time, but rather a holding time established by the subcontract laboratory. The subcontract laboratory reports that thiodiglycol is known to be stable in water at least 30 days.

- Total Dissolved Solids: Sample GW1-MW-90C was prepared for total dissolved solids analysis three days past the holding time of seven days.

All samples were analyzed for the correct compound and analyte lists and met PQLs as defined in Tables 2-2 through 2-6A of the CDAP Addendum with the following exceptions:

- VOCs: Due to matrix interferences, samples GW1-MW-13, GW1-MW-52B and GW1-MW-50 were diluted at 1:10. Quantitation limits were increased accordingly.
- Metals: Due to matrix interferences, several samples were diluted at 1:2, 1:5, 1:10, and/or 1:20 for arsenic, lead, and/or selenium. The quantitation limits were increased accordingly.
- Explosives: Due to insufficient sample volume provided by the field, sample GW1-MW-83A was prepared with 520 mL of sample volume rather than 950 mL as specified in the methodology. The quantitation limits were increased accordingly.
- Several VOCs, base-neutral and acid compounds, and pesticides/PCBs PQLs exceeded NJDEP GWQS as explained in Section 2.2.1 of the July 1995 CDAP Addendum. A detailed discussion can be found in Appendix H, Section 3.0.

All laboratory blanks and field blanks were free from the target compound and analyte contamination above the PQLs defined in the CDAP Addendum with the following exceptions:

- Some volatile organic blanks contained the common volatile contaminant methylene chloride at levels less than four times the CRQL.
- Some semivolatile blanks contained the common phthalate contaminants at levels less than four times the CRQLs.
- One metals blank contained arsenic at a negative concentration greater than the PQL (2.23 ug/L).
- Trip blanks TB-16NOV94 and TB-18NOV94 contained the common volatile contaminant methylene chloride at levels greater than five times the CRQL.

Field duplicate precision showing an overall %RPD of 99.4% was achieved. Precision criterion of 20% RPD for groundwaters was used for all methods. The overall percent completeness (including Laboratory Quality Control Samples and Matrix Quality Control Samples) for groundwater and field blank water samples was 97.0%, which exceeded the completeness goal of 95%. The calculation of completeness evaluated the laboratory-generated data and was independent of the data evaluation performed by TDMS.

All data generated by the laboratory were subjected to data evaluation performed by TDMS. Some organic and inorganic results were qualified as estimated (J) as a result of not meeting specific QC requirements. These results can be used "as is", as per NJDEP guidelines. Some metals and organic compounds were not detected at PQLs exceeding the GWQS; however, the majority of these metals and organic compounds are not of concern. Several nondetections of selenium and tetryl results were rejected during TDMS data evaluation due to low QC spike recoveries. The nonrejected data, however, indicate that they are not contaminants of concern in the groundwater. All SW-846 method protocols were fully followed for the samples, including postdigestion spike analyses and/or reextractions/reanalyses to further document matrix interferences for some samples. No further method-driven corrective action is required as per SW-846 protocols. Therefore, the nonrejected data are sufficient to support an evaluation of the extent of groundwater contamination within the former Arsenal.

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SECTION 6.0

NATURE AND EXTENT OF CONTAMINATION OF CONCERN

The nature and extent of groundwater contaminants of concern at the former Arsenal was determined based on the analytical results of soil, groundwater, surface water and sediment sampling events. Groundwater contour maps based on three rounds of water level monitoring were used to determine the direction and hydraulic gradients associated with the overburden and bedrock aquifers. Compound-specific contaminants of concern, contamination plume locations and potential source areas for contamination have been identified. The main groundwater contaminants of concern at the former Arsenal are VOC and metal compounds. In addition, potential on-site and off-site sources (DOD and non-DOD) of groundwater contamination are addressed.

6.1 VOC CONTAMINATION IN GROUNDWATER

Consistent with the results of the SGWS investigation, plumes of VOC contamination have been identified and confirmed based on two rounds of monitoring well groundwater sampling. The main VOC contaminants of concern are TCE, PCE and total-1,2-DCE, with contaminants of lesser frequency being 1,2-DCA, benzene, chlorobenzene, dichlorobromomethane and vinyl chloride. Benzene, chlorobenzene, 1,2-DCA, dichlorobromomethane and vinyl chloride were each detected at five or fewer wells out of the 119 wells sampled site-wide during the Phase 2 RI. During the Round 1 groundwater sampling event, benzene was detected above the GWQS at five of 119 locations sampled; chlorobenzene was detected above the GWQS at two of 119 locations sampled; 1,2-DCA was detected at two of 119 locations sampled; dichlorobromomethane was detected at one of 119 locations sampled; and vinyl chloride was detected at five of 119 locations sampled. The VOCs 1,2-DCA, benzene, chlorobenzene, dichlorobromomethane and vinyl chloride were not detected in any of the 67 wells sampled during the Round 2 groundwater sampling event. The suspected source areas of the main VOCs of concern are consistent with those previously identified during the SGWS investigation and are evaluated below. It should be noted that the SGWS data performed by WESTON is consistent with an NJDEP-approved work plan and the NJDEP Technical Requirements. The water quality information obtained during the SGWS is similar to that from a monitoring well, except that the sampling procedures and analytical data are not reproducible. Additionally, SGWS locations lack subsurface soil stratigraphy information which would be collected at monitoring wells. This lack of geologic data can potentially complicate the interpretation of the SGWS data due to the presence of these stratigraphic units. Specifically, WESTON can not be sure whether certain SGWS locations were collected above or below confining units (i.e., MM), thus affecting the data interpretation.

It is significant to note that PCE and TCE degradation compounds were detected in this AOC as well as other AOCs offsite. The degradation of PCE and TCE in groundwater is well documented in current literature and indicates that natural attenuation (via the process of natural anaerobic degradation) is occurring within VOC plumes at the former Arsenal. The presence of breakdown products such as total-1,2-DCE, 1,1-DCE, chloroethane and vinyl chloride indicate that the sources of the VOCs are not recent, as there has been sufficient time for breakdown products to form. However, a specific timeline for the natural anaerobic degradation of PCE/TCE at the site has not been determined.

6.1.1 AOC 1 - Vicinity of Raritan Plaza I and II

AOC 1 is located within the northeastern portion of the former Arsenal, near the Ramada and Holiday Inn hotels, approximately 3,000 feet upgradient of Area 15. This plume underlies background areas near MW-40 and is assumed to extend northward upgradient of the background MW-103 well cluster. The eastern, western and southern boundaries of this plume were estimated by using five SGWS investigation locations (SGW-16, SGW-121, SGW-122, SGW-145 and SGW-146) and two monitoring wells (MW-103A and MW-40) (Figure 5-1).

The AOC 1 plume contains TCE, total 1,2-DCE and PCE (Figures 5-2, 5-3, and 5-4). PCE was detected above the NJDEP GWQS of 1.0 ug/L at MW-103A (8.0 ug/L) during Round 1 (Figure 5-4). During Round 2, PCE was detected at MW-103A (8.0 ug/L) and MW-40 (3.0 ug/L) (Figure 5-24). Total 1,2-DCE was detected above the GWQS of 10.0 ug/L at MW-103A (40.0 ug/L) during Round 1 (Figure 5-3). During Round 2, total 1,2-DCE was detected at MW-103A (48.0 ug/L) and MW-40 (11.0 ug/L) (Figure 5-23). TCE was detected above the NJDEP GWQS of 1.0 ug/L at MW-103A (7.0 ug/L) during Round 1 (Figure 5-2). During Round 2, TCE was detected at MW-103A (8.0 ug/L) and MW-40 (8.0 ug/L) (Figure 5-22). Total VOC SGWS results were confirmed by Round 1 and Round 2 monitoring well sampling. Total VOC concentrations at SGWS locations SGW-23 (24.1 ug/L) and SGW-120 (3.4 ug/L) correlated reasonably well with groundwater sampling results. Total targeted VOC concentrations detected during Round 1 for wells within AOC 1 were 55.0 ug/L (MW-103A), and during Round 2 were 64.0 ug/L (MW-103A) and 44.0 ug/L (MW-40).

The AOC 1 plume movement trend is southeast, consistent with overburden LS groundwater flow directions (Figure 4-10, 4-11 and 4-12). TCE values from both sampling rounds indicate similar concentrations over a one month period, with the plume migration emanating from an off-site source. TCE and total-1,2 DCE were detected above the GWQS in Area 15 (MW-84A), in line with the downgradient flow direction of the AOC 1 plume. Based on the absence of VOCs at seven SGWS points and two monitoring wells (MW-83A and MW-85A) upgradient of Area 15, the AOC 1 plume does not appear to be associated with the Area 15 VOCs. This information indicates that another on-site source of VOC exists upgradient of MW-84A.

Based on information presented in the Limited Surrounding Land Use Survey Report (Appendix C), the former Fedders Air Conditioner Corporation or New York Times facility are potential sources of the VOC contaminants detected in MW-103A. The Fedders facility had a documented septic disposal area, drum storage area and a storm sewer system. Petroleum hydrocarbons, PAHs and VOCs were detected in soil borings in the vicinity of these facilities. Another potential source of VOC contamination in this area is the former Edison Township sewage treatment plant located near the entrance to Raritan Center. During the construction of the Holiday Inn, soil contamination was reportedly encountered and remediated in this area.

6.1.1.1 Associated Soil Contamination

Since soil samples were not collected for chemical analysis during the installation of the MW-103 well cluster or near Raritan Plaza I, the relationship of soil contamination to groundwater contamination in this AOC 1 cannot be evaluated. During the drilling of the MW-103 cluster (Appendix A), HNu readings of soil samples did not indicate any soil contamination.

6.1.1.2 Associated Surface Water and Sediment Contamination

Surface water and sediment samples were not collected for chemical analysis in the vicinity of AOC 1. AOC 1 is physically located within both the East Ditch and Black Ditch Drainage Areas (Figure 4-22). The relationship of surface water and sediment contamination to groundwater contamination within AOC 1 cannot be evaluated.

6.1.2 AOC 2 - Area 18C Building 256

AOC 2 is located within the north central portion of the former Arsenal, beginning near Building 256 in Area 18C. The AOC 2 plume extends southeast, underlying the physical boundaries of Areas 2, 3 and Building 151 (Figure 5-1). The northern border of this plume is estimated to be just south of the Inland Container Corporation property. The southern border of the plume has been estimated to be approximately half-way across Areas 2 and 3. The western border has been estimated to be the northeastern tip of Area 18C, and the eastern border of the AOC 2 plume is just east of the Building 151 boundary. These borders were determined by Round 1 groundwater sampling results from five overburden wells and from 12 previous SGWS locations. VOCs were not detected in groundwater samples collected from MW-15, MW-18, MW-104A/C and MW-SA4 well locations.

The AOC 2 plume contains TCE, total 1,2-DCE, PCE, vinyl chloride and benzene (Figures 5-2, 5-3, 5-4, 5-5 and 5-6). PCE was detected above the NJDEP GWQS of 1.0 ug/L at MW-SPCI4 (22.0 ug/L), MW-SA5 (22.0 ug/L), MW-81A (31.0 J ug/L), and MW-58 (13.0 ug/L) during Round 1 (Figure 5-4). Total 1,2-DCE was detected above the GWQS of 10.0 ug/L at MW-SPCI4 (36.0 ug/L), MW-SA5 (220 ug/L), MW-81A (260 ug/L) and MW-13 (180 ug/L) during Round 1 (Figure 5-3). TCE was detected above the NJDEP GWQS of 1.0 ug/L at MW-SPCI4

(150 ug/L), MW-SA5 (240 ug/L), MW-81A (590 ug/L), MW-13 (300 ug/L), MW-14 (7.0 ug/L) and MW-58 (110 ug/L) during Round 1 (Figure 5-2). Benzene was detected above the NJDEP GWQS of 1.0 ug/L at MW-13 (72.0 ug/L) during Round 1 (Figure 5-6). Vinyl chloride was detected above the GWQS of 5.0 ug/L at MW-SA5 (16.0 ug/L) and MW-81A (10.0 J ug/L) during Round 1 (Figure 5-5). As proposed in the Work Plan, the monitoring wells in the vicinity of AOC 2 were not sampled during the Round 2 groundwater sampling event. Total VOC SGWS results were confirmed by Round 1 monitoring well sampling. Total VOC concentrations at SGWS locations SGW-21 (7.0 ug/L), SGW-22 (1.9 ug/L), SGW-30 (3.0 ug/L), SGW-68 (31.0 ug/L), SGW-94 (13,320 ug/L), SGW-95 (40.0 ug/L), SGW-96 (244 ug/L), SGW-97 (2.9 ug/L), SGW-150 (1.0 ug/L) and SGW-151 (3.5 ug/L), correlated very well with monitoring well sampling results. Total targeted VOC concentrations detected at wells within AOC 2 ranged from 123 ug/L (MW-58) to 893 ug/L (MW-81A) during the Round 1 groundwater sampling event. The AOC 2 plume trends in a southeasterly direction, consistent with overburden LS groundwater flow directions (Figure 4-10, 4-11 and 4-12).

The AOC 2 plume is located in the vicinity of Building 256, and is suspected to be related to historic DOD operations and liquid waste disposal into a leachfield. A hand drawn leach field at the northeast corner of Building 256 is indicated on the Raritan Arsenal "Master Plan of Utilities; Sanitary Sewer System Map Dated 26 September 1952". Information obtained by WESTON could not confirm that VOCs were used in the building. Benzene was detected at one location (MW-13) within AOC 2. Based on its distribution, the source of benzene in groundwater does not appear to be related to the PCE, TCE and DCE detected within AOC 2. Historical groundwater sampling results from monitoring wells located in the vicinity of Building 151 indicated that elevated halogenated VOCs were present throughout this area of the former Arsenal.

Additional investigations are planned in the Building 256 area, with test pits and soil samples to be collected as part of the Work Plan Addendum. The purpose of these work activities is to determine if the Building 256 leachfield is the source of VOC contaminants identified in groundwater.

6.1.2.1 Associated Soil Contamination

Soil samples have not been collected for chemical analysis in the vicinity of Building 256. The relationship of soil contamination to groundwater contamination in AOC 2 cannot be evaluated at this time. Based on the Work Plan Addendum, a test pit and soil sampling program will be performed. Test pits and possible geoprobe sampling will be performed to evaluate potential sources of contamination.

6.1.2.2 Associated Surface Water and Sediment Contamination

Surface water sampling locations SW-1812, SW-1813, SW-1814, SW-1815, SW-1816 and SW-1817 were closest to the suspected source area at Building 256. Surface water analyses detected VOCs at SW-1813 (2.0 J ug/L of 1,1-DCE), SW-1814 (2.0 J ug/L of 1,1,1-TCA) and SW-1815 (5.0 ug/L of TCE and 14.0 J ug/L of 1,1-DCE), located directly south of Building 256. The VOCs detected in surface water are most likely related to groundwater infiltration of VOCs from the AOC 2 plume and subsequent interception of groundwater with a surface water body. All other nearby surface water locations (SW-1812, SW-1816 and SW-1817) did not indicate detectable amounts of VOCs. VOCs were not detected in sediments in the nearest sampling locations.

TCE concentrations are higher in groundwater than in surface water in the vicinity of AOC 2. Groundwater discharge is a likely contributor to TCE contamination in surface water. This is particularly true in Area 18C, where the lower portion of the Area 18C stream (Figure 4-21) was found to be a "gaining" stream as shown by water levels in MW-EPA-2A and SG-12 (Table 4-6). Comparisons of surface water elevations to groundwater elevations between three rounds of data (Table 4-6) indicate that groundwater is providing a source of water for surface water streams in Area 18. The average hydraulic head difference between SG-12 and MW-EPA2A is 13.40 feet; between SG-14 and MW-7 is 5.51 feet; and between SG-14 and MW-8 is 7.59 feet.

6.1.3 AOC 3 - Owens-Illinois

AOC 3 is located in the northwestern portion of the former Arsenal, bordered by Route 514 (Woodbridge Avenue) to the northwest, to the south by the USEPA complex, and to the east by Inland Container Corporation. Eight SGWS locations and one monitoring well (MW-88A) assisted in defining the VOC plume at AOC 3. Total VOC concentrations at SGWS locations SGW-12 (203 ug/L) and SGW-20 (21.9 ug/L) clarified and defined the extent of the AOC 3 plume (Figure 5-1). A location near the rear of the Owens-Illinois building is believed to be a potential source area. The AOC 3 plume extends beyond the physical boundary of the Owens-Illinois property. The plume location was not clearly confirmed by groundwater sampling, except for a MW-88A, which detected TCE (4.0 ug/L) and total-1,2-DCE (17.0 ug/L) (Figures 5-2 and 5-3). The MW-88A location is believed to be at the leading edge of the VOC plume, based on the groundwater and SGWS investigations. TCE was not detected in monitoring well MW-82A, which is located in the middle of the borings advanced at Owens-Illinois at the location of the former aboveground tank farm.

Based on the Work Plan Addendum, additional groundwater sampling of wells in Areas 18B, 18C, 18D, 18E, 18F and 18G has been proposed. One round of groundwater samples will be collected from MW-EPA4A, MW-EPA5A, MW-EPA6A and MW-EPA7A. This sampling will provide additional information by which the AOC 3 plume can be evaluated.

6.1.3.1 Associated Soil Contamination

Eight soil borings were drilled and a monitoring well installed within the location of the former aboveground tank farm on the Owens-Illinois property as part of the Phase 2 RI. The results of the soil borings are presented in the Owens-Illinois ROI Soils report. The report indicated that TCE was detected in sample SS-OW04A at a concentration of 0.004 J mg/kg. The low concentration of TCE present in the soil at the former tank farm location at Owens-Illinois does not appear to be impacting groundwater quality.

6.1.3.2 Associated Surface Water and Sediment Contamination

Surface water and sediment samples were not collected for chemical analysis within the boundary of AOC 3. AOC 3 is physically located within the Red Root Creek Drainage Area (Figure 4-22). Surface water and sediment samples were collected downgradient of AOC 3 in the Area 18C streams. VOCs were detected in surface water in the Area 18C streams and may be associated with AOC 3.

6.1.4 AOC 4 - Former Pond at Area 18A

AOC 4 is located in the north central portion of the former Arsenal. A VOC plume extends in a southeasterly direction from Area 18A; encompassing Areas 1, 18B, 18C, 19 and 20. The plume was defined by using SGWS and Round 1 groundwater results. Thirteen SGWS locations and groundwater sampling results from wells in Area 18A (MW-EPA2A and MW-71C), Area 10 (MW-46A and MW-57), Area 20 (MW-10) and Area 1 (MW-7, MW-8, MW-9, MW-31, MW-89A and MW-89C) were used to evaluate plume size and extent (Figure 5-1). The unusual shape of the AOC 4 plume is likely due to potential multiple source areas and variations in the saturated thickness and the presence of fine-grained materials (clays and silts) in the LS.

The AOC 4 plume contains TCE, total 1,2-DCE, PCE, vinyl chloride and benzene (Figures 5-2, 5-3, 5-4, 5-5, and 5-6). TCE was detected above the NJDEP GWQS of 1.0 ug/L at MW-7 (5.0 ug/L), MW-8 (82.0 ug/L), MW-31 (48.0 ug/L), MW-46A (27.0 ug/L), MW-87A (7.0 ug/L) and MW-88A (17.0 ug/) during Round 1 (Figure 5-2). During Round 2, TCE was detected at MW-87A (5.0 ug/L) and MW-88A (3.0 ug/L) at concentrations exceeding the NJDEP GWQS (Figure 5-22). Total 1,2-DCE was detected above the GWQS of 10.0 ug/L at MW-EPA2A (160 ug/L), MW-8 (14.0 ug/L), MW-31 (13.0 ug/L), MW-46A (120 ug/L), and MW-88A (17.0 ug/L) during Round 1 (Figure 5-3). During Round 2, total 1,2-DCE was not detected at any locations within AOC 4 above the NJDEP GWQS. PCE was detected above the GWQS of 1.0 ug/L at MW-87A (2.0 ug/L) during both the Round 1 and 2 groundwater sampling events (Figures 5-4 and 5-24). Benzene was detected above the NJDEP GWQS of 1.0 ug/L at MW-46A (1.8 ug/L) during Round 1 (Figure 5-6). During Round 2, benzene was not detected at any locations within AOC 4 above the NJDEP GWQS. Vinyl chloride was detected above the GWQS of 5.0 ug/L at MW-EPA2A (38.0 ug/L) and MW-46A (13.0 ug/L) during Round 1

(Figure 5-5). During Round 2, vinyl chloride was not detected at any locations within AOC 4 above the NJDEP GWQS. It should be noted that many of the OBG and Dames & Moore wells which detected VOCs during Round 1 were not sampled during Round 2.

Total VOC SGWS results were confirmed by Round 1 and 2 groundwater sampling. Total VOC concentrations at SGWS locations SGW-27 (11.7 ug/L), SGW-35 (24.5 ug/L), SGW-36 (310 ug/L), SGW-44 (28.2 ug/L), SGW-76 (2.7 ug/L), SGW-83 (104 ug/L), SGW-84 (66.8 ug/L), SGW-85 (20.1 ug/L), SGW-89 (2.5 ug/L), SGW-92 (2.2 ug/L) and SGW-140 (6.3 ug/L) correlated very well with groundwater sampling results (Figure 5-1). Total targeted VOC concentrations for monitoring wells associated with AOC 4 ranged from 8.0 ug/L (MW-8) to 199 ug/L (MW-EPA2A) during Round 1. During Round 2, total targeted VOC concentrations ranged from 1.6 ug/L (MW-89A) to 7.0 ug/L (MW-87A). The AOC 4 plume is trending in a southeasterly direction consistent with overburden LS groundwater flow directions (Figure 4-10, 4-11 and 4-12).

The former GSA/US Army Pond Area was a manmade, unlined impoundment that was historically utilized as a dumping ground. It is one of the main potential sources of groundwater contamination at the site.

6.1.4.1 Associated Soil Contamination

IT Corporation conducted an investigation and performed remediation activities in Area 18A from June 1992 through February 1993, under the direction of the Omaha District of the USACE. During the investigation and remediation in Area 18A, IT Corporation removed oily residues, tar-like sludges and grossly contaminated soils from the pond. Approximately 15,000 gallons of surface water and 46 drum carcasses were removed. Although remediation of visibly contaminated soils within Area 18A was completed, evaluation of the draft closure report indicated that residual levels of contamination remained in the soil at the site. The analytical results of sludge and soil samples collected from the pond indicated elevated concentrations of TCE, 1,2-DCA, xylenes, PAHs and a variety of other VOCs, SVOCs and pesticides.

The analytical results of soil samples collected as part of the Phase 2 RI in the vicinity of the former pond at Area 18A indicated that xylene was present at a concentration of 15.0 mg/kg in sample SS-18A16C (9.5 to 10.0 feet BGS), exceeding the NJDEP IGWSCC of 10.0 mg/kg. All other soil samples collected for VOC analysis during the Phase 2 RI contained VOC concentrations below the most stringent NJDEP soil cleanup criteria. Other soil sampling within the AOC 4 plume indicated the following VOCs were present in the soil at concentrations below NJDEP soil cleanup criteria:

- TCE was detected in Area 18A soil samples SS-18A06A, SS-18A06B, SS-18A06C and SS-18A11B at concentrations ranging from 0.005 J mg/kg to 0.039 mg/kg. Groundwater samples collected from five monitoring wells located in the vicinity of Area 18A detected TCE at concentrations exceeding the NJDEP GWQS ranging from 2.0 ug/L to 82.0 ug/L.

- Total 1,2-DCE was detected in Area 18A soil samples SS-18A06A, SS-18A06C and SS-18A11B at concentrations ranging from 0.004 J mg/kg to 0.990 J mg/kg. Groundwater samples collected from two monitoring wells located in the vicinity of Area 18A detected 1,2-DCE at concentrations exceeding the NJDEP GWQS ranging from 120 ug/L to 160 ug/L.

- Total 1,2-DCE was detected in Area 1 soil sample SS-0101C at a concentration of 0.017 J mg/kg. Groundwater samples collected from two monitoring wells located in the vicinity of Area 1 detected 1,2-DCE at concentrations exceeding the NJDEP GWQS ranging from 3.0 ug/L to 14.0 ug/L.

- PCE was detected in Area 19 soil samples SS-1937A (2.0 to 2.5 feet BGS) and SS-1937B (4.5 to 5.0 feet BGS) at concentrations of 0.055 mg/kg and 0.030 mg/kg, respectively. Soil boring 1937 is located in the northeast corner of Area 19.

Based on the recommendations in the Area 18A ROI soils report, some additional soil sampling and test pits are planned for this area to evaluate potential remaining locations of soil contamination. A geophysical survey was performed within Area 18A and detected several subsurface anomalies. These anomalies will also be investigated.

6.1.4.2 Associated Surface Water and Sediment Contamination

The analytical results of the surface water and sediment investigation indicate that TCE was detected at surface water sampling locations associated with the Area 18B stream (SW-1808 and SW-1809) and the Area 18B lower stream (SW-0101, SW-0102, SW-0103 and SW-0104). TCE was detected in two of the seven surface water sample locations in the Area 18B stream at concentrations of 16.0 ug/L (SW-1808) and 14.0 ug/L (SW-1809). TCE was not detected in the western portion of Area 18B stream at locations SW-1803 through SW-1807. TCE was detected in the Area 18B lower stream at surface water locations SW-0101 (20.0 ug/L), SW-0102 (18.0 ug/L), SW-0103 (16.0 ug/L) and SW-0104 (13.0 ug/L).

The surface water sampling locations within the Area 18B and 18C streams where TCE was detected correspond to the AOC 4 groundwater plume of TCE identified in this area. Since groundwater TCE concentrations (undetected to 82.0 ug/L) were generally higher than surface water concentrations (undetected to 20 ug/L), and groundwater elevations are within 10 feet of the ground surface in this area of the site, it is likely that the surface water TCE contamination observed in this area is related to groundwater seepage into these streams. This is also supported by staff gauge data from SG-14 in the lower 18B stream, which suggests the stream is "gaining" groundwater in this vicinity. Comparisons of surface water elevations to groundwater elevations between three rounds of data (Table 4-6) indicate groundwater is providing a source of water for surface water streams in Area 18. Average hydraulic head differences between SG-12 and MW-EPA2A is 13.40 feet, between SG-14 and MW-7 is 5.51 feet, and between SG-14 and MW-8 is 7.59 feet.

6.1.5 AOC 5 - Area 10 Tennis Court Area

AOC 5 is located within the northwestern portion of the former Arsenal, near the tennis courts in Thomas Edison County Park, upgradient of Area 19 (Figure 5-1). This small plume underlies Area 10, and is of limited extent within Area 10. The borders of the AOC 5 plume were defined based on VOC results from five SGWS locations. The extent of the AOC 5 plume was based on total VOC concentrations at SGWS locations SGW-25 (110 ug/L) and SGW-119 (23.7 ug/L) (Figure 5-1). There are no nearby monitoring wells with which to correlate the Round 1 groundwater sampling results to the SGWS results. The nearest monitoring wells downgradient of AOC 5 are MW-56 and MW-70A. VOCs were not detected in the groundwater samples collected from either MW-56 or MW-70A.

Potential sources for this small plume include a historical storage shed for oil, activity related to Magazines 402, 406 and 407 (based on the Dames & Moore Archival Report), or activity related to non-DOD sources of VOCs (such as past construction operations, storage and vehicle maintenance in the County Park). The Area 10 Draft ROI dated August 1994 indicates that soil AOC 3 (Stained Area Between Tennis Courts and Baseball Field No. 1) is located within groundwater plume AOC 5. The analytical soil results from the three borings advanced with the soil AOC 3 did not detect any VOCs, except methylene chloride and acetone at very low concentrations. Arsenic was the only compound present within the soil in this area at concentrations exceeding NJDEP soil cleanup criteria.

6.1.5.1 Associated Soil Contamination

Surface soil sampling conducted in this area by Dames & Moore did not detect organic soil contamination above either the NJDEP RDCSCC or IGWSCC. Three soil borings were drilled within AOC 3 (Stained Area Between Tennis Courts and Baseball Field No. 1) during the Phase 2 RI, as presented in the Area 10 Draft ROI dated August 1994. Soil AOC 3 in Area 10 is located within groundwater plume AOC 5. The Phase 2 RI soil sampling did not detect any VOCs of concern.

6.1.5.2 Associated Surface Water and Sediment Contamination

Surface water and sediment samples were not collected in the immediate vicinity of AOC 5. AOC 5 is physically located within the County Park Drainage Area (Figure 4-22).

6.1.6 AOC 6 - Area 19

AOC 6 is physically located within Areas 9, 10 and 19 in the central and western portions of the former Arsenal (Figure 5-1). AOC 6 plume is bordered on the north and west by Area 10, on the south by Area 19, on the west by Area 10, and on the east by Areas 8 and 19. AOC 6 was delineated on the basis of groundwater sampling results from five monitoring wells during Round 1 and 13 SGWS locations (Figure 5-1).

The AOC 6 plume contains TCE, total 1,2-DCE, PCE and benzene (Figures 5-2, 5-3, 5-4 and 5-6). TCE was detected above the NJDEP GWQS of 1.0 ug/L at MW-47A (30.0 ug/L), MW-48A (8.0 ug/L), MW-48B (24.0 ug/L) and MW-80 (11.0 ug/L) during Round 1 (Figure 5-2). During Round 2, TCE was detected in MW-80A (12.0 ug/L) at a concentration exceeding the GWQS (Figure 5-22). PCE was detected above the NJDEP GWQS of 1.0 ug/L at MW-48A (16.0 ug/L) and MW-48B (3.0 ug/L) during Round 1 (Figure 5-4). During Round 2, PCE was not detected at any locations within AOC 6 above the NJDEP GWQS. Total 1,2-DCE was detected above the GWQS of 10.0 ug/L at MW-47A (110 ug/L) during Round 1 (Figure 5-3). During Round 2, total 1,2-DCE was not detected at any locations within AOC 6. Benzene was detected above the GWQS of 1.0 ug/L at MW-47A (7.0 ug/L) during Round 1 (Figure 5-6). During Round 2, benzene was not detected at any locations within AOC 6. It should be noted that monitoring wells installed by OBG and Dames & Moore were not sampled during Round 2, consistent with the approved Work Plan.

Total VOC SGWS results were confirmed by the Round 1 and 2 groundwater sampling. Total VOC SGWS results from 13 locations ranged in concentration from 1.1 ug/L to 4,280 ug/L, and correlated reasonably well with groundwater sampling results. Total VOC concentrations in wells MW-47A, MW-48A/B and MW-80A, associated with AOC 6, ranged in concentration from 11.0 ug/L (MW-80A) to 149 ug/L (MW-47A). The AOC 6 plume trends east-west, consistent with overburden LS groundwater flow directions (Figure 4-10, 4-11 and 4-12).

The source of the AOC 6 plume is unknown, but may be related to possible DOD-related storage activities (Historical Archival Report indicates oil and grease waste storage associated with Building 520), handling of VOCs in magazines, or other more recent site activities not related to previous DOD activities (light manufacturing or industrial processes). AOC 6 is located downgradient of AOC 4, presently associated with the former pond at Area 18A, but there does not appear to be any connection between the plumes.

6.1.6.1 Associated Soil Contamination

Dames & Moore and OBG soil investigations in this area did not detect organic contaminants above either the NJDEP RDCSCC or IGWSCC. However, OBG detected low concentrations of toluene in several deep soil samples. A soil gas survey performed by Dames & Moore during the Phase 1 RI detected low concentrations of VOCs (TCE and BTEX) in the soil. The results of the Phase 2 RI soil sampling did not indicate any VOCs of concern.

6.1.6.2 Associated Surface Water and Sediment Contamination

TCE was detected in surface water within the Northeastern Wetlands of the Old Red Root Creek Drainage Area in Area 19. TCE was detected at surface water locations SW-1908 (20.0 ug/L), SW-1909 (3.0 ug/L) and SW-1910 (7.0 ug/L). The presence of TCE in surface water may be related to groundwater contamination. However, the nearest staff gauge (SG-5) and monitoring well (MW-54) indicate a consistent trend of "losing stream" (Table 4-6). The average hydraulic head difference between three rounds of water level measurements is 0.91 feet. This suggests that surface water may be contributing to groundwater contamination; however, there is not sufficient information available at this time to make a definitive determination. Monitoring wells MW-48A (8.0 ug/L) and MW-48B (24.0 ug/L) contained TCE at concentrations exceeding the NJDEP GWQS during the Round 1 sampling event. These two wells are located upgradient of Old Red Root Creek.

6.1.7 AOC 7 - Area 7

AOC 7 is located within the north-central portion of the former Arsenal (Figure 5-1). The AOC 7 plume underlies Area 7 and trends southeasterly direction toward Area 6. The AOC 7 plume has been delineated by five SGWS locations (SGW-54, SGW-98, SGW-99, SGW-100 and SGW-102) and two monitoring wells (MW-11 and MW-59) (Figure 5-1).

The AOC 7 plume contains TCE, total 1,2-DCE, PCE, vinyl chloride, benzene, chlorobenzene and 1,2-DCA (Figures 5-2, 5-3, 5-4, 5-5, 5-6, 5-7 and 5-8). TCE was detected above the NJDEP GWQS of 1.0 ug/L at MW-11 (9.0 ug/L) and MW-59 (13.0 ug/L) during Round 1 (Figure 5-2). PCE was detected above the NJDEP GWQS of 1.0 ug/L at MW-11 (3.0 ug/L) during Round 1 (Figure 5-4). Total 1,2-DCE was detected above the GWQS of 10.0 ug/L at MW-11 (16.0 ug/L) and MW-59 (21.0 ug/L) during Round 1 (Figure 5-3). Benzene was detected above the NJDEP GWQS of 1.0 ug/L at MW-11 (4.0 ug/L) and MW-59 (50.0 ug/L) during Round 1 (Figure 5-6). Vinyl chloride was detected above the NJDEP GWQS of 5.0 ug/L at MW-59 (15.0 ug/L) during Round 1 (Figure 5-5). Chlorobenzene was detected above the GWQS of 4.0 ug/L at MW-11 (82.0 ug/L) and MW-59 (450 ug/L) during Round 1 (Figure 5-7). The VOC 1,2-DCA was detected above the GWQS of 2.0 ug/L at MW-11 (14.0 ug/L) and MW-59 (16.0 ug/L) during Round 1 (Figure 5-8). MW-11 and MW-59 were not resampled during Round 2, as per the Work Plan.

Total VOC SGWS results were confirmed by the Round 1 groundwater sampling. The total VOC concentrations at SGWS locations SGW-45 (370 ug/L) and SGW-101 (42.7 ug/L) correlated very well with groundwater sampling results. Total VOC concentrations in monitoring wells associated with AOC 7 ranged from 162 ug/L (MW-11) to 580 ug/L (MW-59).

Potential sources for the VOC contamination identified in AOC 7 include a possible former aboveground storage tank, a former ammunition renovation plant, a former TNT sump and the current PSE&G vehicle maintenance facility.

6.1.7.1 Associated Soil Contamination

The results of the Dames & Moore soil gas survey indicated the possible presence of VOCs in the subsurface soil. A subsequent sample location (B7-1) contained elevated concentrations of VOCs. The results of the Phase 2 RI soil sampling conducted in Area 7 indicated the presence of the following VOCs of concern.

- Total 1,2-DCE was detected in Area 7 soil samples SS-0701A, SS-0701B, SS-0705A, SS-0709A and SS-0709B of concentrations ranging from 0.002 J mg/kg to 0.110 mg/kg. Total 1,2-DCE concentrations in groundwater samples collected from MW-11 and MW-59 in AOC 7 ranged from 16.0 ug/L to 21.0 ug/L, respectively.

- TCE was detected in Area 7 in soil sample SS-0705A (1.0 to 1.5 feet BGS) at a concentration of 0.007 mg/kg. Groundwater samples collected from monitoring wells MW-11 and MW-59, located in AOC 7, detected TCE at concentrations of 9.0 ug/L and 13.0 ug/L, respectively.

- PCE was detected in Area 7 in soil sample SS-0705A (1.0 to 1.5 feet BGS) at a concentration of 0.034 J mg/kg. Groundwater samples collected from monitoring wells MW-11 and MW-59 detected PCE at concentrations of 3.0 ug/L and 13.0 ug/L, respectively.

6.1.7.2 Associated Surface Water and Sediment Contamination

Surface water and sediment samples were collected from the Area 20 Ditch, Area 8 Pond and Red Root Creek for chemical analyses in the vicinity of AOC 7. AOC 7 is physically located within the Red Root Creek Drainage Area (Figure 4-22). VOCs of concern were not detected in the surface water or sediment samples collected in the vicinity of Area 7, with the exception of SD-2002. Sediment sample SD-2002 was collected in Area 20 and contained 0.002 J mg/kg of total 1,2-DCE.

6.2 METALS CONTAMINATION IN GROUNDWATER

Based on the Phase 2 RI groundwater sampling results, the total metal concentration of aluminum, antimony, arsenic, cadmium, chromium, iron, lead, manganese, mercury, nickel and sodium exceeded the NJDEP GWQS in one or more monitoring wells during the Round 1 and/or Round 2 groundwater sampling events. Iron, manganese and sodium occur naturally and are not considered metals of concern. A discussion of these three metals is presented in Section 6.5.

Cadmium, chromium, and mercury are not considered to be contaminants of concern, as each of these metals exhibited only a single exceedance of GWQS during one sampling round. Antimony exceeded the GWQS at only 3 of 119 wells sampled. Nickel exceeded the GWQS at only 2 of 119 wells sampled. Lead exceeded the GWQS at only 6 of 119 wells sampled. A discussion of these metals is presented in Section 6.2.4.

Aluminum and arsenic are the primary metals of concern in the groundwater at the former Arsenal. Aluminum and arsenic were present in the greatest numbers of groundwater samples exceeding the GWQS in both the Round 1 and Round 2 sampling events. Aluminum was detected above the GWQS in 24 of 39 wells sampled, and arsenic was detected above the GWQS in 24 of 119 wells sampled Arsenal-wide.

6.2.1 Aluminum Contamination

Aluminum in groundwater is considered to be a site-wide contaminant of concern at the former Arsenal. Aluminum was detected in groundwater during the Round 1 sampling event at concentrations ranging from 33.9 ug/L to 76,900 ug/L, with a site-wide average of 2,941 ug/L. The NJDEP GWQS for aluminum is 200 ug/L. Groundwater samples were collected from 39 monitoring wells for aluminum analysis (TAL metals). Twenty-four of the 39 groundwater samples collected during the Round 1 sampling event contained aluminum at concentrations exceeding the NJDEP GWQS.

Aluminum is predominately present in wells near major drainage features of the former Arsenal. The wells with aluminum concentrations that exceed the NJDEP GWQS are located in the East Ditch, Black Ditch, Red Root Creek, Central Ditch, Area 12 and Old Red Root Creek drainage areas, with most of the aluminum contamination observed in wells associated with Black Ditch and Red Root Creek.

Monitoring wells that exceeded the GWQS for aluminum of 200 ug/L during the Round 1 sampling event included: MW-9 (630 ug/L) and MW-88C (240 ug/L) in Area 1; MW-14 (3,480 ug/L), MW-15 (253 ug/L) and MW-58 (2,210 ug/L) in Area 3; MW-19 (386 J ug/L) and MW-76A (3,950 ug/L) in Area 4; MW-21 (214 J ug/L), MW-22 (825 ug/L) and MW-66 (386 ug/L) in Area 5; MW-96A (1,370 J ug/L) in Area 6; MW-27 (5,810 ug/L), MW-97A (4,760 ug/L) and MW-97B (1,290 J ug/L) in Area 6A; MW-99A (573 ug/L) in Area 6B; MW-12 (1,940 ug/L) in Area 7; MW-46A (2,060 ug/L) and MW-57 (4,400 J ug/L) in Area 10; MW-100A (76,900 ug/L) in Area 11; MW-50 (867 ug/L) and MW-77A (2,250 ug/L) in Area 14; MW-90C (2,050 ug/L) in Area 16; MW-49 (1,570 J ug/L) in Area 19; and MW-82A (414 ug/L) in Owens-Illinois (Figure 5-12).

Monitoring wells that exceeded the GWQS for aluminum during the Round 2 sampling event include: MW-76A (6,010 ug/L) in Area 4; MW-66 (399 ug/L) in Area 5; MW-96A (648 ug/L) in Area 6; MW-79C (7,850 J ug/L) in Area 8; MW-100A (1,530 J ug/L) in Area 11; MW-90A

(1,730 ug/L) and MW-90C (554 ug/L) in Area 16; and MW-82A (1,510 ug/L) in Owens-Illinois (Figure 5-28).

Aluminum in the groundwater may be associated with natural levels of aluminum in soil (both overburden and bedrock) or related to historic fill material used during construction of buildings, roads and structures by DOD or private landowners. A review of the Dames & Moore Archival Search Report does indicate some potential DOD-related aluminum sources. During 1958, the Arsenal Laboratory experimented with using a paint remover to strip aluminum and magnesium parts. Additional information concerning aluminum use at the former Arsenal was not found during a review of the Archival Search Report.

A report dated 27 April 1928 indicates an archival study of three industries located in the vicinity of the former Arsenal; the American Smelting and Refining Company, the American Incaustic Tile Works and the United Lead Company. These historical references indicate the potential for some aluminum related processes that may have impacted the elevated aluminum concentration in groundwater.

MW-103C (background bedrock well) had aluminum in groundwater at a concentration of 33.9 ug/L, and MW-82A (an upgradient LS aquifer well) had an aluminum concentration of 414 ug/L during Round 1, and 1,510 ug/L during Round 2. During the Phase 2 RI Round 1 and 2 groundwater sampling events, a limited number of wells (39 out of 119) were analyzed for aluminum. However, based on the Phase 2 RI sampling results and the distribution of the wells sampled for TAL metals, aluminum appears to be wide-spread within the groundwater of the former Arsenal.

6.2.1.1 Associated Soil Contamination

Aluminum was detected in soil site-wide during the Phase 2 RI at concentrations ranging from 131 mg/kg to 34,670 mg/kg, with a site-wide average concentration of 5,612 mg/kg. The NJDEP has not established a soil cleanup criteria for aluminum. Aluminum was detected at fairly uniform concentrations in the majority of soil across the former Arsenal. However, aluminum was detected at slightly higher concentrations in the southern portion of the site in Areas 6, 11, 14, and 16. This indicates a correlation between the highest groundwater concentrations of aluminum and areas associated with potential dredge spoils.

6.2.1.2 Associated Surface Water and Sediment Contamination

In contrast to other metals; on a site-wide basis, aluminum concentrations in groundwater were higher than those measured in surface water. Aluminum occurs in soils at a range of zero to 3.5 percent (based on WESTON soil samples), with average levels of 0.5 percent in former Arsenal soils. Aluminum concentrations in groundwater (with the exception of well MW-100A, 76,900 ug/L) ranged from undetected to 7,850 ug/L. In most wells, aluminum concentrations were less than 2,000 ug/L. Surface water aluminum concentrations were lower, ranging from undetected to 5,660 ug/L, with the exception of location SW-0615 (67,300 ug/L) in the sulfur plant ponds. At most locations, surface water concentrations were less than 1,000 ug/L. Surface water was analyzed for TAL metals at 40 of the 114 locations sampled.

6.2.2 Area 14 - Arsenic

Based on the groundwater sampling of Area 14, each of the nine monitoring wells associated with Area 14 indicated the presence of arsenic in groundwater. Of these nine wells, three detected arsenic at concentrations exceeding the GWQS of 8.0 ug/L (Figure 5-10). The well screened in the US unit (MW-50) detected the highest concentration of arsenic Arsenal-wide, with a concentration of 398 J ug/L. Final turbidity results collected during Round 1 groundwater sampling from MW-50 indicate 38.4 NTU's, which could have an affect on the analytical results. LS wells MW-77A (17.0 ug/L) and MW-98A (14.8 J ug/L), located within or associated with Area 14, had concentrations of arsenic above the GWQS. The four wells MW-50B (5.30 J ug/L), MW-77B (7.20 ug/L), MW-78A (4.70 ug/L) and MW-98B (4.30 ug/L) screened at or near the base of the LS unit, detected arsenic at concentrations below the GWQS. MW-45 (3.10 J ug/L) also detected arsenic at a concentration below the GWQS, but was screened across the US, MM and LS units. Arsenic was not detected in the bedrock well MW-50C at a detection limit of 8.5 UJ ug/L.

During Round 2, arsenic was detected above the GWQS at MW-98A (15.20 ug/L) in the LS wells (Figure 5-29). In addition, wells MW-77A (5.60 ug/L), MW-50B (3.40 ug/L), MW-77B (2.90 ug/L) and MW-78A (2.40 ug/L), screened with the LS unit, detected arsenic at concentrations below the GWQS. MW-45 and MW-50 were not sampled during the Round 2 event and arsenic was not detected in MW-50C during the Round 2 event.

Based on groundwater contour maps, the predominant overburden groundwater flow direction at Area 14 is to the south (Figures 4-10, 4-11 and 4-12). The geology underlying Area 14 has a MM unit that ranges in thickness from less than two feet at MW-77B to approximately 10 to 15 feet thick in the vicinity of MW-50 well cluster. Arsenic is present at higher concentrations in groundwater in Area 14 above the MM unit than below the MM unit. The concentration gradients of arsenic between cluster wells MW-50 (398 J ug/L) and MW-50B (5.30 J ug/L); MW-77A (17.0 ug/L) and MW-77B (7.2 ug/L); and MW-98A (14.8 J ug/L) and MW-98B (4.3 J ug/L) indicate that the MM unit is providing a barrier to the downward migration of arsenic.

6.2.2.1 Area 14 Associated Arsenic Soil Contamination

Arsenic was present at concentrations exceeding the NJDEP RDCSCC, NRDCSCC and IGWSCC of 20 mg/kg in 25 of the 29 soil borings advanced in Area 14 during the Phase 2 RI. The average concentration of arsenic detected during the Phase 2 soil investigation in Area 14 was 113 mg/kg. The distribution of sampling locations and average arsenic levels encountered across Area 14 indicated that the horizontal extent of the arsenic contamination is generally uniform across Area 14. Arsenic concentrations increased with depth at 21 of the 29 boring locations advanced; however, soil samples collected from the deepest interval in all borings were obtained immediately above the groundwater table, thereby determining the vertical extent of the arsenic contamination in the vadose zone.

6.2.2.2 Area 14 - Arsenic in Surface Water and Sediment

Eleven surface water and sediment samples (SW-1402 through SW-1412) were collected in or near Area 14. Arsenic was only detected in two of the 11 surface water sampling locations [SW-1410 (148 ug/L) and SW-1411 (15.3 ug/L)]. Arsenic was only detected in sediment sample SD-1407 (9.8 J ug/L). A comparison of staff gauge (SG-10) and monitoring well (MW-98A/B) information in the vicinity of Area 14 indicates variable hydraulic head differences. During the first and third water elevation events, the predominant trend was a "gaining stream", while during the second event the trend was a "losing stream". Based on three rounds of measurements, the dominant trend is gaining; however, this is likely effected by tidal fluctuations.

6.2.3 <u>Arsenic Site-Wide</u>

Arsenic in groundwater is also a site-wide contaminant of concern at the former Arsenal. Arsenic was detected in the groundwater above the GWQS of 8.0 ug/L during both the Round 1 and 2 sampling events. Groundwater samples were collected from 119 monitoring wells during the Round 1 sampling event and from 67 wells during the Round 2 sampling event. Arsenic was detected in 56 samples during the Round 1 sampling event at concentrations ranging from 1.80 J ug/L (MW-34) to 398 J- ug/L (MW-50). Twenty-four of the 119 groundwater samples collected during Round 1 contained arsenic at concentrations exceeding the NJDEP GWQS of 8.0 ug/L, including 21 wells outside of the vicinity of Area 14. Arsenic was detected in 32 samples during the Round 2 sampling event at concentrations ranging from 1.8 ug/L (MW-88A) to 22.5 ug/L (MW-97A). Eight of the 67 groundwater samples collected during Round 2 contained arsenic at concentrations exceeding the GWQS, including 7 wells outside of the vicinity of Area 14.

6.2.3.1 Arsenic Distribution Site-Wide

Arsenic in groundwater is present at concentrations exceeding the GWQS throughout the southern half of the former Arsenal (Figure 5-10). Arsenic was either not detected or detected at concentrations below the GWQS in the northern half of the former Arsenal. As shown on Figure 5-10, 24 monitoring wells detected arsenic concentrations above the GWQS during the Round 1 sampling event. The concentrations of arsenic over the GWQS ranged from 8.2 ug/L (MW-16) in Area 6A to 398 ug/L (MW-50) in Area 14. All exceedances of the GWQS were detected south of Areas 4, 7, 8, 14 and 19 (Figure 5-10). The analytical results for the Round

2 sampling event indicated that arsenic only exceeded the GWQS in the southern half of the former Arsenal. Arsenic was detected in groundwater samples collected from 33 of the 67 Round 2 wells sampled. Nine Round 2 monitoring wells contained arsenic at concentrations exceeding the GWQS (Figure 5-29). The concentrations of arsenic over the GWQS ranged from 11.1 ug/L (MW-76B) in Area 4 to 22.5 ug/L (MW-97A) in Area 6A during Round 2.

The source of arsenic contamination appears to be both natural and related to past DOD activities. Historical usage of sodium arsenite as a herbicide (arsenic trioxide and sodium hydroxide) by the DOD to keep 50 feet of clearance on all sides of the former magazines in the southern half of the site is believed to be one source of this contaminant. Dredge deposits and the Raritan River may also serve as sources of arsenic contamination.

6.2.3.2 Associated Soil Contamination

Arsenic was detected in soil during the Phase 2 RI at concentrations ranging from 0.12 mg/kg to 398 mg/kg, with a site-wide average concentration of 21.0 mg/kg. The NJDEP RDCSCC, NRDCSCC and IGWSCC for arsenic are each 20 mg/kg.

As shown on Figure 5-10, arsenic was detected in groundwater above the NJDEP GWQS in the southern half of the former Arsenal (Areas 6, 11, 12, 14, and 16). The highest concentration of arsenic (398 ug/L) in groundwater was detected in MW-50 in Area 14, an area where dredge spoils have historically been deposited. Arsenic was detected in the soil at concentrations exceeding the NJDEP soil cleanup criteria in Areas 3, 6, 8, 10, 11, 14, 16, and 19. Arsenic was consistently detected at concentrations exceeding the NJDEP soil cleanup criteria in Areas 6 and 14. The highest concentrations of arsenic in soil and groundwater are both located in Area 14. In addition, arsenic is present throughout the southern portion of the former Arsenal in both soil and groundwater. The presence of arsenic in soil and groundwater are related; however, given the extensive distribution of arsenic in soil, there does not appear to be readily identifiable point sources for groundwater contamination beyond Area 14.

6.2.3.3 Associated Surface Water and Sediment Contamination

Arsenic concentrations in groundwater ranged from undetected to 398 ug/L. Concentrations were highest in Areas 6, 11 and 14, which are areas known to have received dredge spoil deposition. Surface water arsenic concentrations were comparable, and ranged from undetected to 945 ug/L, with most locations having concentrations less than 20 ug/L. Arsenic concentrations in sediment at the former Arsenal ranged from undetected to 186 mg/kg.

The hypothesized route of metals contamination is the leaching of dredge spoils or other metals-contaminated soils into surface water or entering via runoff, eventually percolating into groundwater in some cases, depending on grain size and organic content of sediments and soil. The fate and effect of arsenic toxicity is determined largely by its availability, which in turn is affected by both water chemistry and physical processes such as temperature, degree of aeration, microbial transformation, presence of organic material, etc. These act to determine the chemical form of arsenic present, as well as the degree to which is bound to other materials, such as organic material or suspended solids. Another major factor affecting toxicity, which is not addressed here, is the ability of a particular organism to regulate uptake or to transform arsenic into non-toxic forms. In surface water, the form of arsenic present depends on Eh, pH, organic content, suspended solids, DO and other variables. Arsenates in surface water may also coprecipitate with or adsorb to hydrous iron oxides, and form insoluble precipitates with calcium, sulfur, aluminum and barium compounds, as well as manganese. The degree of arsenic adsorption to the sediment (and hence bioavailability) is governed not only by the arsenic concentration in the surface water, but by the pH, grain size, and organic content of the sediment.

6.2.4 Metals Site-Wide (Excluding Aluminum and Arsenic)

Iron, manganese and sodium are naturally occurring throughout the former Arsenal and cannot be attributed to past DOD activities. A discussion of background (naturally occurring) groundwater quality for these three metals is present in Section 6.5. Antimony, cadmium, chromium, mercury and nickel are not considered to be contaminants of concern. Lead is a potential contaminant of concern for Area 4. The Phase 2 sampling results and distribution for each of these contaminants are discussed below.

6.2.4.1 Metals Distribution Site-Wide

Antimony was detected in four of the 119 wells sampled during the Round 1 groundwater sampling event. Antimony was detected at a concentration exceeding the GWQS of 20 ug/L in three of the four wells in which it was detected. Antimony exceeded the GWQS in monitoring wells MW-60C (27.2 ug/L), MW-94A (28.8 ug/L) and MW-97B (39.2 ug/L) (Figure 5-16). MW-97B and MW-94A are located in Area 6 and MW-60C is located in Area 12. Antimony was not detected above the GWQS in any of the 67 wells sampled during the Round 2 groundwater sampling event.

Cadmium was detected in 19 of the 119 wells sampled during Round 1. Cadmium was detected at a concentration equal to the GWQS of 4.0 ug/L in one monitoring well (MW-66) (Figure 5-18). Cadmium was detected in 11 of the 67 wells sampled during Round 2. Cadmium was detected at concentrations exceeding the GWQS in monitoring wells MW-66 (4.3 J+ ug/L) and MW-67 (5.0 J- ug/L) during the Round 2 sampling event (Figure 5-30). Both MW-66 and MW-67 are located in Area 5 along Black Ditch.

Chromium was detected in 28 of the 119 wells sampled during Round 1. Chromium was only detected at a concentration exceeding the GWQS of 100 ug/L in MW-100A (271 J ug/L) during Round 1 (Figure 5-19). MW-100A is located in Area 11. Chromium was not detected above the GWQS in any of the 67 wells sampled during Round 2. Chromium was detected at a concentration of 13.6 ug/L in MW-100A during the Round 2 sampling event.

Lead was detected in 23 of the 119 wells sampled during Round 1. Lead was detected above the GWQS of 10 ug/L at six of the 23 locations where it was detected. Lead was detected above the GWQS in wells MW-43 (13.7 ug/L), MW-52A (14.5 J- ug/L), MW-57 (11.1 J- ug/L), MW-63A (10.4 J- ug/L), MW-69A (31.6 J- ug/L) and MW-76A (20.3 ug/L) (Figure 5-15). Monitoring wells MW-43 and MW-76A are located in Area 4; MW-57 and MW-69A are located within Area 10; MW-52A is located in Area 16; and MW-63A is associated with Area 11. Lead was not detected above the GWQS in any of the 67 wells sampled during Round 2.

Mercury was detected in seven of the 119 wells sampled during Round 1. Mercury was only detected at a concentration exceeding the GWQS of 2.0 ug/L in MW-85A (3.0 J ug/L) (Figure 5-20). MW-85A is located in Area 15. Mercury was not detected above the GWQS in any of the 67 wells sampled during Round 2.

Nickel was detected in 37 of the 39 wells sampled during Round 1. Nickel was only detected at a concentration above the GWQS of 100 ug/L in MW-47A (151 ug/L) and MW-100A (164 ug/L) (Figure 5-17). MW-47A is associated with Area 9 and MW-100A is located in Area 11. Nickel was detected in 12 of the 67 locations sampled during Round 2. Nickel was only detected above the GWQS in MW-96A (172 ug/L) during Round 2 (Figure 5-31). MW-96A is located in Area 6.

The source of antimony, cadmium, chromium, lead, mercury, and nickel contamination in groundwater is believed to be a combination of natural concentrations of these metals in soil and manmade contributions related to general DOD and non-DOD activities or to dredge spoils (in the southern portion of the site). The concentrations of these metals in groundwater exceed the GWQS, but remain fairly low. In addition, the distribution of these metals is sporadic and cannot be clearly linked to past DOD-related activities. With the exception of lead downgradient of Area 4, these metals are not considered to be contaminants of concern based on their limited distribution and occasional exceedances.

Lead was initially considered a potential contaminant of concern for Areas 3 and 4 due to the GWQS exceedances in MW-43 and MW-76A. Since lead was not detected in MW-42A and MW-17, which are much closer to the Area 4 source location (fenced area); not detected in MW-15 and MW-58; and detected well below the GWQS at MW-14 (3.4 ug/L) much closer to Areas 2 and 3, it was removed from consideration as a contaminant of concern for these areas. MW-76A is located at a large soil and debris mound unrelated to DOD activities which is downgradient from an active railway yard. MW-43 is located adjacent to a large active railway storage and switching yard and a maintenance garage for Federal Business Centers.

6.2.4.2 Associated Soil Contamination

Aluminum, antimony, arsenic, cadmium, chromium, iron, lead, manganese, mercury, nickel and sodium were detected at concentrations exceeding the NJDEP GWQS during the Round 1 sampling event. Antimony, arsenic, barium, beryllium, cadmium, copper, lead, mercury, thallium, and zinc were detected at concentrations exceeding the most stringent NJDEP soil cleanup criteria during the Phase 2 RI soil activities throughout the former Arsenal. This section discusses the relationship between the concentration of antimony, cadmium, chromium, iron, lead, manganese, mercury and nickel in groundwater and their associated concentrations in soil. The NJDEP has not established soil cleanup criteria for iron and manganese; therefore, the concentration of these metals in groundwater are compared to the average concentration of these metals in soil site-wide. A discussion of aluminum and arsenic in soil was presented in Sections 6.2.1, 6.2.2 and 6.2.3.

Site-wide average analytical concentrations discussed below were calculated by adding the analytes concentrations without qualifiers, analyte concentrations with "J" qualifiers "as is", and one-half of the sample detection limits for analyte concentrations with the "U" qualifier, then dividing the sum by the number of samples analyzed for that analyte. Average site-wide detected concentrations discussed below were also calculated by adding concentrations without qualifiers and analyte concentrations with "J" qualifiers "as is", then dividing the sum by the number of samples. The purpose of calculating site-wide averages using two different methods was to analyze and review the data consistent with the NJDEP Technical Requirements (N.J.A.C. 7:26E-4.9). Additionally, WESTON calculated the site-wide concentrations detected to interpret the analytical data without biasing (i.e., using 1/2 of the "U" value). It should be noted that this information was not used for the determination of compliance with any NJDEP standard/criteria, but for general purposed in presenting site-side concentrations of specific compounds of concern.

Antimony was detected in soil during the Phase 2 RI at concentrations ranging from 0.2 mg/kg to 130 mg/kg, with a site-wide average concentration of 0.91 mg/kg. The average site-wide detected concentration of antimony in soil was 2.31 mg/kg. The NJDEP RDCSCC and NRDCSCC for antimony are 14 mg/kg and 340 mg/kg, respectively. Antimony was detected in soil above the RDCSCC in Areas 2, 6B and 14. Antimony was detected above the GWQS of 20.0 ug/L in three of 119 locations sampled during the Round 1 Phase 2 RI groundwater sampling event. The groundwater samples which exceeded the GWQS were collected from Areas 6, 6A and 14. Antimony was not detected above the GWQS in any of the 67 wells sampled during the Round 2 groundwater sampling event.

Barium was detected in soil during the Phase 2 RI at concentrations ranging from 0.37 mg/kg to 1,480 mg/kg, with a site-wide average concentration of 31.64 mg/kg. The average site-wide detected concentration of barium in soil was 33.92 mg/kg. The NJDEP RDCSCC and NRDCSCC for barium are 700 mg/kg and 47,000 mg/kg, respectively. Barium was detected in the soil at concentrations exceeding the RDCSCC at one location in Area 6. Analytical soil results from the Dames & Moore investigation detected barium at one location (B17A-3) with a concentration of 766 mg/kg, exceeding the RDCSCC of 700 mg/kg. Barium was not detected above the GWQS of 2,000 ug/L during the Round 1 (39 wells) and Round 2 (20 wells) Phase 2 RI groundwater sampling events.

Beryllium was detected in soil during the Phase 2 RI at concentrations ranging from 0.06 mg/kg to 3.0 mg/kg, with a site-wide average concentration of 0.35 mg/kg. The average site-wide detected concentration of beryllium in soil was 0.52 mg/kg. The NJDEP RDCSCC and NRDCSCC for beryllium are each 1.0 mg/kg. Beryllium was detected in the soil at concentrations exceeding the RDCSCC in Areas 3, 6, 11, 14 and 19. Beryllium was not detected above the GWQS of 20 ug/L during either the Round 1 and Round 2 Phase 2 RI groundwater sampling events.

Cadmium was detected in soil during the Phase 2 RI at concentrations ranging from 0.01 mg/kg to 16.20 mg/kg, with a site-wide average concentration of 0.27 mg/kg. The average site-wide detected concentration of cadmium in soil was 0.71 mg/kg. The NJDEP RDCSCC, NRDCSCC and IGWSCC for cadmium are 1.0 mg/kg, 100 mg/kg and 100 mg/kg, respectively. During the Phase 2 RI cadmium was detected in soil above the RDCSCC of 1.0 mg/kg in Areas 3, 6A, 10, 14, 16, 18A and 20. Cadmium was detected at the GWQS of 4.0 ug/L in one (MW-66 located in Area 5) of the 119 locations sampled during the Round 1 Phase 2 RI groundwater sampling event. Cadmium exceeded the GWQS at two (located in Area 5) of 67 locations sampled during the Round 2 sampling event.

Chromium was detected in soil during the Phase 2 RI at concentrations ranging from 0.80 mg/kg to 262 mg/kg, with a site-wide average concentration of 29.60 mg/kg. The average detected concentration of chromium in soil was 29.84 mg/kg. The NJDEP RDCSCC and NRDCSCC for chromium are each 500 mg/kg. The analytical soil results for the Dames & Moore investigation indicate that chromium was not detected site-wide at concentrations exceeding the RDCSCC. Chromium was detected at a concentration exceeding the GWQS of 100 ug/L in one (MW-100A located in Area 11) of 119 locations sampled during the Phase 2 RI groundwater sampling event. During the Round 2 groundwater sampling event, chromium did not exceed the GWQS at any of the 67 locations sampled.

Copper was detected in soil during the Phase 2 RI at concentrations ranging from 0.83 mg/kg to 632 mg/kg, with a site-wide average concentration of 42.21 mg/kg. The average detected concentration of copper in soil was 44.07 mg/kg. The NJDEP RDCSCC and NRDCSCC for copper are each 600 mg/kg. Copper was detected at one soil boring location in Area 14 at a concentration exceeding the RDCSCC. Copper was not detected above the GWQS of 1,000 ug/L during either the Round 1 (119 wells) or Round 2 (67 wells) Phase 2 RI groundwater sampling events.

Iron was detected in soil sample collected during the Phase 2 RI at concentrations ranging from 155 mg/kg to 64,500 mg/kg, with a site-wide average concentration of 15,073 mg/kg. The NJDEP has not established a soil cleanup criteria for iron. Iron was detected above the GWQS of 300 ug/L in both bedrock and overburden wells during the Phase 2 RI groundwater sampling. Iron in groundwater is attributed to background water quality conditions. A discussion of background (naturally occurring) groundwater quality for metals is presented in Section 6.5.

Manganese was detected in soil during the Phase 2 RI at concentrations ranging from 3.20 mg/kg to 11,700 mg/kg, with a site-wide average concentration of 1,244 mg/kg. The average detected concentration of manganese in soil was 1,412 mg/kg. The NJDEP has not established a soil cleanup criteria for manganese. Manganese was detected above the GWQS of 50.0 ug/L in both bedrock and overburden wells during the Phase 2 RI groundwater sampling. Manganese in groundwater is attributed to background water quality conditions. A discussion of background (naturally occurring) groundwater quality for metals is presented in Section 6.5.

Mercury was detected in soil during the Phase 2 RI at concentrations ranging from 0.06 mg/kg to 91.2 mg/kg, with a site-wide average concentration of 0.55 mg/kg. The NJDEP RDCSCC and NRDCSCC for mercury are 14 mg/kg and 270 mg/kg, respectively. Mercury was detected above the RDCSCC in Area 2 during the Phase 2 RI. The average detected concentration of mercury in soil was 2.10 mg/kg. Mercury was detected above the RDCSCC at location B2-36 (26.2 mg/kg) in Area 2 during the Dames & Moore investigation. Mercury was detected above the GWQS of 2.0 ug/L in one (MW-85A located in Area 15) of 119 locations sampled during the Phase 2 RI groundwater sampling event. During the Round 2 sampling event, mercury did not exceed the GWQS at any of 67 locations sampled.

Nickel was detected in soil during the Phase 2 RI at concentrations ranging from 0.80 mg/kg to 64.90 mg/kg, with a site-wide average concentration of 6.90 mg/kg. The average detected concentration of nickel in soil was 9.81 mg/kg. The NJDEP RDCSCC and NRDCSCC for nickel are 250 mg/kg and 2,400 mg/kg, respectively. Nickel was detected above the GWQS of 100 ug/L in two of 119 locations sampled during the Round 1 Phase 2 RI groundwater sampling event. One of the two wells with elevated nickel concentrations was located in Area 9 and the other was located in Area 11. During the Round 2 sampling event, nickel was detected above the GWQS at one (MW-96A located in Area 6) of 67 locations sampled.

Sodium was detected in soil during the Phase 2 RI at concentrations ranging from 6.30 mg/kg to 7,730 mg/kg, with a site-wide average concentration of 246 mg/kg. The average detected concentration of sodium in soil was 769 mg/kg. The NJDEP has not established a soil cleanup criteria for sodium. Sodium was detected above the GWQS of 50,000 ug/L in overburden and bedrock monitoring wells during the Phase 2 RI groundwater sampling event. Sodium in groundwater is attributed to background water quality conditions. A discussion of background (naturally occurring) groundwater quality for metals is presented in Section 6.5.

Thallium was detected in soil during the Phase 2 RI at concentrations ranging from 0.17 mg/kg to 3.40 mg/kg, with a site-wide average concentration of 0.46 mg/kg. The average detected concentration of thallium in soil was 1.35 mg/kg. The NJDEP RDCSCC and NRDCSCC for thallium are each 2.0 mg/kg. Thallium was detected in soil above the RDCSCC in Areas 6, 14 and 19. Thallium was not detected above the GWQS of 10 ug/L during either the Round 1 or Round 2 Phase 2 RI groundwater sampling events.

Zinc was detected in soil during the Phase 2 RI at concentrations ranging from 2.40 mg/kg to 1,620 mg/kg, with a site-wide average concentration of 43.47 mg/kg. The average detected concentration of zinc in soil was 62.27 mg/kg. The NJDEP RDCSCC and NRDCSCC for zinc are each 1,500 mg/kg. Zinc was detected in soil above the RDCSCC at one location in Area 10. Zinc was not detected above the GWQS of 5,000 ug/L during either the Round 1 or Round 2 Phase 2 RI groundwater sampling events.

Lead was detected in soil during the Phase 2 RI at concentrations ranging from 0.14 mg/kg to 1,800 mg/kg, with a site-wide average concentration of 48.1 mg/kg. The NJDEP RDCSCC, NRDCSCC and IGWSCC for lead are 400 mg/kg, 600 mg/kg and 2,000 mg/kg (Area 17 criteria), respectively. Only three of the soil samples collected site-wide during the Phase 2 RI contained lead at concentrations exceeding the NJDEP RDCSCC of 400 mg/kg. Samples with elevated lead concentrations included SS-18A02A (576 mg/kg) and SS-18A04A (1,800 mg/kg), located in Area 18A, and sample SS-0330Z (442 mg/kg), located in Area 3. The majority of the samples with lead concentrations between 200 mg/kg and 400 mg/kg during the Phase 2 RI were collected from Areas 6 and 14. The analytical soil results of the Dames & Moore samples collected from borings advanced within the fenced portion of Area 4 indicated concentrations of lead below the RDCSCC. In Area 3, Dames & Moore sampling results indicate that lead was detected in 15 of the 29 soil samples collected, with concentrations ranging from 103 mg/kg to 1,360 mg/kg. Five of the 29 samples collected by Dames & Moore contained lead at concentrations exceeding the NJDEP RDCSCC of 400 mg/kg. All of the soil samples collected by Dames & Moore in Area 2 contained lead at concentrations below the RDCSCC. During the Phase 2 RI lead was detected at concentrations exceeding the GWQS of 10 ug/L in wells located in Areas 4, 10, 12 and 16. On a site-wide basis, there does not appear to be a relationship between soil concentrations of lead and associated groundwater concentrations.

6.2.4.3 Associated Surface Water and Sediment Contamination

While several metals were detected in groundwater at levels exceeding NJDEP criteria, nearly all of these compounds occurred at lower concentrations in groundwater than in surface water. Based on their frequency and magnitude of contamination at the former Arsenal, the following metals were previously identified as potential contaminants of concern in surface water and sediment: lead, arsenic, copper, nickel, zinc, mercury, chromium, cadmium, and silver. Of these, lead, arsenic, chromium and cadmium were detected in prior investigations at levels exceeding NOAA sediment guidelines (WESTON Draft Report of Investigation for Surface Water and Sediment, Section 1.2.3).

Lead, copper, arsenic, nickel and zinc were the most widespread metals of concern in surface water and sediment, although other compounds such as mercury and chromium were also detected at concentrations exceeding sediment quality guidelines or water quality criteria. All of these metals exceeded regulatory criteria or guidelines more often in sediment than in surface water, and all were found to a lesser degree in groundwater than in surface water. This suggests the primary source of metals in groundwater is likely due to infiltration of metals from soil, particularly in areas where dredge spoils were disposed, such as Areas 6, 6A, 6B, 11, 12, 14 and 16.

Lead concentrations in groundwater ranged from undetected to 31.6 ug/L, with most locations having concentrations less than 10 ug/L. In contrast, surface water lead concentrations were somewhat higher, ranging from undetected to 487 J ug/L, with lead levels less than 20 ug/L at most locations. In sediment, lead concentrations at the former Arsenal ranged from undetected to 487 mg/kg.

Copper concentrations ranged from undetected to 50.1 ug/L in the groundwater wells sampled, with most wells sampled having copper concentrations less than 15 ug/L. In surface water, copper concentrations ranged from undetected to 817 ug/L, and varied highly throughout the site. Copper concentrations in sediment at the former Arsenal ranged from undetected to 2,850 mg/kg.

Nickel concentrations in groundwater sampled at the former Arsenal ranged from undetected to 172 ug/L, while surface water concentrations from undetected to 224 ug/L. While surface water concentrations may be influenced by dredge spoil deposition, groundwater concentrations were highest in Areas 9 and 15, which are not known to be affected by dredge material. Nickel concentrations in sediment ranged from undetected to 163 J mg/kg.

Zinc concentrations in groundwater ranged from 3.0 ug/L to 1,490 ug/L and were less than 100 ug/L in most of the wells sampled, while surface water concentrations ranged from 5.2 ug/L to 6,940 ug/L. Zinc concentrations in surface water were quite variable, with the highest concentrations detected in the sulfur plant ponds (2,900 ug/L to 6,940 ug/L), in the East Ditch drainage (42.2 ug/L to 239 ug/L), the Area 5 pond (376 J ug/L), at the head of the Southwest Ditch (1,110 ug/L) and near the head of Red Root Creek (299 ug/L at high tide, 809 ug/L at low tide). Zinc concentrations in sediment ranged from undetected to 1,120 mg/kg.

Since groundwater concentrations of most metals are lower on a site-wide basis than surface water and sediment concentrations, the source of metals contamination is likely due to dredge spoils, or other natural or surficial metals contamination. Another explanation for the accumulation of metals in the south-southeast portion of the site may be that the contaminated groundwater at the site flows south-southeast, and accumulates metals in the fine, organic-rich sediments in that portion of the site.

While properties of individual metals can affect their mobility and uptake, metals transport from soil and the land surface at the former Arsenal can be expected to be via surface water runoff, erosion, and eventual percolation into groundwater, assuming metals are not bound and trapped by fine-grained or organic sediments. The fact that soil and sediment concentrations of several metals are generally higher on a per location basis than in surface water and groundwater suggests that wetlands in the southern portion of the site may be acting to forestall metals migration by trapping metals in fine-grained sediments with higher amounts of organic matter.

6.3 TREND ANALYSIS OF GROUNDWATER QUALITY

WESTON performed a review and evaluation of the existing analytical groundwater data obtained during sampling conducted by OBG, Dames & Moore and WESTON (Phase 2 RI - Rounds 1 and 2). The purpose of this evaluation was to qualitatively determine the trends in groundwater contamination over time, keying in on specific contaminants of concern. The contaminants evaluated during the trend analysis included: total VOCs, PCE, TCE, total 1,2-DCE, arsenic, lead, cadmium and chromium.

Groundwater samples were only collected for laboratory analysis from a select group of monitoring wells during each sampling event (OBG, Dames & Moore, WESTON Round 1 and WESTON Round 2). The trend analysis utilized all available data for which there were at least two groundwater results for a single well. This resulted in the largest sample population and the most analytical information to evaluate. Table 6-1 presents the analytical groundwater results used in the evaluation of the trend analysis. Each contaminant of concern is listed along with all applicable monitoring wells and their associated analytical result for each sampling event. All monitoring wells are listed for which there was at least one detected concentration of the contaminant of concern. If a contaminant of concern was not detected in the groundwater samples collected during all four rounds, that well was not listed in Table 6-1.

The trend analysis evaluates whether contaminant concentrations increase, decrease, or remain constant over time. OBG collected groundwater samples (only VOC and total metals analyses were used) during a sampling event spanning November and December 1988 and January 1989; Dames & Moore collected groundwater samples during July and August 1992; and WESTON collected groundwater samples during November 1994 (Round 1) and December 1994 (Round 2).

It should be noted that the following factors may effect the trend analysis, but were not accounted for during the evaluation: variability between analytical results from sampling methods, variability between analytical methods and analytical procedures over time (between OBG and WESTON) and environmental conditions at the time of sampling.

6.3.1 VOCs

6.3.1.1 Total VOCs

Targeted VOCs were detected in a total of 35 wells over the four groundwater sampling events. Seventeen of the 35 locations consisted of newly installed wells, which were only sampled by WESTON. Of the 18 remaining locations (OBG and Dames & Moore), total VOCs concentrations decreased in eight wells, increased in seven wells, and remained relatively unchanged in two wells (Table 6-1). Monitoring well MW-9 had an initial increase in total VOCs from 7.0 ug/L (OBG) to 12.0 ug/L (Dames & Moore) and then had a subsequent decrease in concentration to 8.0 ug/L (WESTON-Round 1). The trend for this well is described as varying over time. Based on a review of the analytical data, it appears that when VOCs are detected, total VOCs are increasing in concentration in 50 percent of the wells and decreasing in concentration the remaining 50 percent of wells.

WESTON conducted two rounds of groundwater sampling during the Phase 2 RI. The Round 1 and Round 2 sampling events were conducted approximately 30 days apart. Total VOC concentrations over the 30 day period increased in four of the 17 wells, decreased in seven of the wells and remained relatively unchanged in six of the wells (Table 6-1). There does not appear to be a trend for total VOC concentrations over the two Phase 2 RI sampling events.

6.3.1.2 PCE

PCE was detected in a total of eight monitoring wells over the four groundwater sampling events. Two (MW-87A and MW-103A) of the eight locations consisted of newly installed wells, which were only sampled by WESTON. Of the six remaining wells, PCE concentrations decreased over time in one well, increased in three wells (MW-11, MW-98A and MW-48B) and remained relatively unchanged in two wells (Table 6-1). The trend of PCE concentrations in groundwater is variable. The increases in PCE concentrations at MW-48A and MW-48B are most likely due to the leading edge of a VOC (AOC 6) plume. The AOC 6 plume is moving consistent with overburden groundwater flow in a southern direction. The decreases in PCE concentrations (MW-13) are most likely the result of natural degradation and PCE plume migration past MW-13.

WESTON conducted two rounds of groundwater sampling during the Phase 2 RI. The Round 1 and Round 2 sampling events were conducted approximately 30 days apart. PCE concentrations over the 30 day period remained constant in the two wells sampled (Table 6-1).

6.3.1.3 TCE

TCE was detected in a total of 21 monitoring wells over the four groundwater sampling events. Seven of the 21 locations consisted of newly installed wells, which were only sampled by WESTON. Of the 14 remaining wells, TCE concentrations decreased over time in 10 of the wells, increased in concentration in two of the wells and remained fairly constant in two of the wells (Table 6-1). This information indicates that TCE concentrations appear to be decreasing site-wide over time. The increase in TCE concentrations at MW-48A and MW-13 is most likely due to continued TCE plume migration (AOC 6), as well as degradation of PCE to TCE. Most well locations show consistent decreases (MW-8, MW-9, MW-11, MW-31, MW-40, MW-46A, MW-47A, MW-48B, MW-58, MW-59 and MW-87A) in TCE concentrations which are attributed to natural degradation and AOC 2, 4, and 6 plume migration.

WESTON conducted two rounds of groundwater sampling during the Phase 2 RI. The Round 1 and Round 2 sampling events were conducted approximately 30 days apart. Total 1,2-DCE concentrations over the 30 day period decreased in one of the seven wells and remained relatively unchanged in the six remaining wells (Table 6-1).

6.3.1.4 Total 1,2-DCE

Total 1,2-DCE was detected in a total of 21 monitoring wells over the four groundwater sampling events. Seven of the 21 locations consisted of newly installed wells, which were only sampled by WESTON. Of the 14 remaining wells, 1,2-DCE concentrations decreased over time in two of the wells, increased in concentration in eight of the wells and remained fairly constant in two of the wells (Table 6-1). MW-9 and MW-31 had 1,2-DCE concentrations which both increased and decreased in concentration over time. The 1,2-DCE concentrations in groundwater appear to be increasing over time. The increase and decrease of total-1,2-DCE at well locations is most likely due to the degradation of PCE and TCE to total-1,2-DCE, as well as the AOC 2, 4, and 6 plumes migration. Groundwater VOC plumes are moving consistent with groundwater flow in a southerly direction. It should be noted that more wells noted increases in total-1,2-DCE concentrations than decreases. This trend (increase in total 1,2-DCE) supports the position of natural attenuation (as a remedial option) of the overburden aquifer.

WESTON conducted two rounds of groundwater sampling during the Phase 2 RI. The Round 1 and 2 sampling events were conducted approximately 30 days apart. Total 1,2-DCE concentrations over the 30 day period increased in three of the seven wells, decrease in one of the wells and remained unchanged in three of the wells (Table 6-1).

6.3.2 <u>Metal Compounds</u>

6.3.2.1 Arsenic

Arsenic was detected in a total of 71 monitoring wells over the four groundwater sampling events. Thirty-seven of the 71 locations consisted of newly installed wells, which were only sampled by WESTON. Of the 34 remaining wells, arsenic concentrations decreased over time in 19 of the wells, increased in concentration in seven of the wells and remained fairly constant in six of the wells (Table 6-1). The groundwater sample collected from MW-63 by WESTON did not detect arsenic at a detection limit of 34.0 ug/L. Dames & Moore detected an arsenic concentration of 8.4 ug/L for this well; therefore, the arsenic trend for this well cannot be determined from the information provided. Overall, the data indicate that arsenic concentrations in groundwater are decreasing with time.

WESTON conducted two rounds of groundwater sampling during the Phase 2 RI. The Round 1 and 2 sampling events were conducted approximately 30 days apart. Arsenic concentrations over the 30 day period increased in nine of the 37 wells, decreased in 16 of the wells and remained unchanged in 12 of the wells (Table 6-1).

6.3.2.2 Lead

Lead was detected in a total of 57 monitoring wells over the four groundwater sampling events. Twenty of the 57 locations consisted of newly installed wells, which were only sampled by WESTON. Of the 37 remaining wells, lead concentrations decreased over time in 26 of the wells, increased in concentration in six of the wells and remained fairly constant in two of the wells (Table 6-1). Overall, the data indicate that lead concentrations in groundwater are decreasing with time.

WESTON conducted two rounds of groundwater sampling during the Phase 2 RI. The Round 1 and Round 2 sampling events were conducted approximately 30 days apart. Lead concentrations over the 30 day period increased in eight of the 20 wells, decrease in four of the wells and remained unchanged in three of the wells (Table 6-1). The trend of lead in five of the 20 wells could not be determined due to elevated detection limits.

6.3.2.3 Cadmium

Cadmium was detected in a total of 30 monitoring wells over the four groundwater sampling events. Seventeen of the 30 locations consisted of newly installed wells, which were only sampled by WESTON. Of the 13 remaining wells, cadmium concentrations decreased over time in seven of the wells and increased in concentration in six of the wells (Table 6-1). Overall, the data indicate that elevated cadmium concentrations in groundwater appear to be decreasing with time.

WESTON conducted two rounds of groundwater sampling during the Phase 2 RI. The Round 1 and Round 2 sampling events were conducted approximately 30 days apart. Cadmium concentrations over the 30 day period increased in eight of the 17 wells and remained unchanged in four of the wells (Table 6-1). Five of the 17 wells had detection limits where the trend of cadmium could not be determined.

6.3.2.4 Chromium

Chromium was detected in a total of 56 monitoring wells over the four groundwater sampling events. Twenty-three of the 56 locations consisted of newly installed wells, which were only sampled by WESTON. Of the 33 remaining wells, chromium concentrations decreased over time in 28 of the wells and increased in concentration in five of the wells (Table 6-1). Overall, the data indicate that chromium concentrations in groundwater are decreasing with time.

WESTON conducted two rounds of groundwater sampling during the Phase 2 RI. The Round 1 and Round 2 sampling events were conducted approximately 30 days apart. Chromium concentrations over the 30 day period increased in 10 of the 23 wells and decreased in nine of the wells (Table 6-1). The trend of chromium in four of the 23 wells could not be determined due to elevated detection limits.

6.4 POTENTIAL DENSE NONAQUEOUS PHASE LIQUID (DNAPL) EVALUATION

In order to evaluate if potential historical releases of Dense Nonaqueous Phase Liquids (DNAPL) have impacted the soils and or groundwater at the former Arsenal, WESTON evaluated historical site usage and data obtained during the Phase 2 RI. This evaluation was based on the USEPA guidance document "Estimating Potential for Occurrence of DNAPL at Superfund Sites" (January 1992), publication number: 9355.4-07FS.

A review of historical site use information indicated that the following processes or waste disposal practices may have occurred during operation of the former Arsenal:

- Metal cleaning/degreasing
- Storage of drummed solvents in uncontained storage areas
- Solvent loading and unloading
- Handling of Hazardous Substances during the normal Arsenal Operations.

According to the USEPA guidance document, these activities indicate the potential presence of DNAPL in the soil and groundwater. In addition, several historic and current non-DOD operations within and surrounding the former Arsenal also have the potential for historic DNAPL releases. These non-DOD related operations are discussed in Section 6.7.

Since the historical information indicates the potential for historical releases of DNAPLs, WESTON evaluated Phase 2 RI data to determine if field observations during drilling, well development, and groundwater sampling have indicated the presence of DNAPLs in soil borings or monitoring wells. During the Phase 2 RI, WESTON drilled approximately 500 soil borings and installed 73 monitoring wells across the site. Field observations during drilling did not indicate the presence of DNAPLs. Significant PID readings, discernable hydrocarbon odors, product or sheen indicating the presence of DNAPL were not noted in soil above the water table. During drilling of monitoring wells significant PID readings, visible sheens, product, and discernable odors indicating the presence of DNAPLs below the saturated/unsaturated interface were not observed. As part of the Phase 2 RI, a total of 73 newly installed monitoring wells were developed, 119 existing and newly installed wells were purged prior to the Round 1 groundwater sampling event, 67 newly installed wells (including four existing wells) were purged prior to the Round 2 groundwater sampling event, and six wells associated with the groundwater investigation of Area 17 were purged prior to groundwater sampling. Based on field observations during development and purging, significant PID readings, discernable odors, visible sheen and measurable product, indicating the potential presence of DNAPLs, were not observed except in Areas 3 and 18A. Area 3 had elevated (above background) responses on PID/flame ionization detectors (FID) at one of 20 soil borings (soil boring 0312). Area 3 has been discounted as a DNAPL source, because the boring encountered an old railroad tie fragment. Area 18A had elevated OVM readings (greater than 100 units) in 6 of 13 locations. A black tar like substance was observed in boring locations 18A08 (between 0-2') and 18A011 (0-4). At location 18A011, a black stain and diesel odor was observed. Many of the wells developed and purged were screened at the base of the LS. During development, and occasionally during purging, pumps were placed at the bottom of the well screen and water was evacuated from the well. Product was not observed in any the groundwater purged from these wells.

Since DNAPLs were not physically observed in the soils or groundwater, the analytical results of soil and groundwater samples collected during the Phase 1 and Phase 2 RI were evaluated for conditions that indicate potential for the presence of DNAPL based on laboratory data, in accordance with the EPA guidance document.

During the Phase 2 RI, approximately 1,000 soil samples were collected site-wide at various depths above the water table from the AOCs (excluding Areas 18B through 18G) and were analyzed for VOCs using GC and GC/MS methods. Based on the analytical results of soil sampling, DNAPL related compounds were detected at low concentrations in soils above the water table. DNAPLs detected in the soil at low concentrations include: 1,1,1-TCA, 1,1-DCA, chlorobenzene, PCE, 1,2-DCE and TCE. These DNAPL related compounds, were detected at concentrations significantly less then the 10,000 mg/kg criteria cited in the EPA guidance document for evaluating the potential for DNAPLs in soil. The highest DNAPL-related compound detected (TCE), was present at a concentration of 0.480 mg/kg in soil boring SS-17112E, collected within Area X, H and W at a depth of 7.5 to 8.0 feet BGS. Recommendations for further investigation of SS-17112E are found in the Area 118 ROI soil report.

During the Phase 1 RI, OBG collected 30 groundwater samples for VOCs, and Dames & Moore collected 52 groundwater samples for VOCs. During the Phase 2 RI, groundwater samples were collected for VOC analysis from six monitoring wells during the expedited Area 17 investigation from 143 SGWS locations, from 118 existing and newly installed wells during the Round 1 groundwater sampling event, and from 62 newly installed wells and four existing wells during the Round 2 groundwater sampling event. The analytical results of all the groundwater samples were compared to the EPA guidance document criteria which specifies that DNAPLs are potentially present if concentrations of DNAPL-related compounds in groundwater are greater than one percent of pure phase solubility. The pure phase solubility of each DNAPL-related chemical detected in groundwater was obtained from the following references:

- Verschueren, K., Handbook of Environmental Data on Organic Chemicals, Van Nostrand Reinhold, New York, NY, 1983.

- Dean, J. A., Lange's Handbook of Chemistry, 14th edition, McGraw-Hill.

In cases where solubilities were reported at different values in the two references, the lower of the two solubility values were used for the DNAPL evaluation. Table 6-2 presents a summary of solubility of DNAPL-related compounds.

Based on an evaluation of all VOC groundwater sampling results, DNAPL-related compounds present at concentrations exceeding the GWQS included chlorobenzene, total 1,2-DCE, 1,1-DCA, 1,2-DCE, TCE and PCE. These compounds were detected mainly in the northern and north central portions of the site (Areas 1, 7, 9, 18A and 19) and have been estimated to comprise six distinct plumes. Based on a comparison of the analytical result to the criteria specified in the EPA guidance document, the concentrations of detected DNAPL-related compounds were, in most cases, significantly less then one percent of the pure phase solubility for each compound. At SGWS sample location GW-SGW-110, located near the Raritan Center Expo Center southeast of Area 9, PCE was detected at a concentration of 1,800 ug/L, slightly above the one percent of the pure phase solubility of 1,500 ug/L for PCE (Table 6-2). This is the only groundwater sample collected during the Phase 1 or Phase 2 RI which detected a DNAPL-related compound concentration above the criteria specified in the EPA guidance document.

Sample GW-SGW-110 was collected from a screened interval of 9.0 to 14.0 feet BGS. Based on the surface elevation, the screened interval, and the distribution of the US and MM units in the vicinity of the sample location, the groundwater sample was collected within the US, US/MM or top of the LS water bearing-zones. An evaluation of analytical results for SGWS sampling locations upgradient, sidegradient, and downgradient of sample GW-SGW-110 indicated that concentrations of PCE were not detected or were detected at concentrations significantly below the one percent of the pure phase solubility for PCE. A similar evaluation of surrounding upgradient and downgradient wells, screened either in the shallow groundwater zones, zones deeper than the depth SGW-110 was collected, or at the bottom of the LS aquifer (MW-48B and MW-92B), either did not detect PCE or detected PCE at concentrations which were significantly below the one percent criteria.

During the evaluation of analytical results, DNAPL-related compounds were not detected in anomalous upgradient or cross gradient locations. However, at monitoring well cluster MW-48A/B the concentrations of TCE in groundwater increased with depth (from 8.0 ug/L in MW-48A to 24.0 ug/L in MW-48B) but were still less than the one percent of pure phase solubility of 10,000 ug/L for TCE.

Since the soil sampling program was biased to AOCs previously reported to have had potential releases, the results of the soil sampling program preclude the possibility of DNAPLs in the unsaturated soils at the AOCs investigated. In addition, the site-wide groundwater sampling program provided sufficient coverage to identify significant VOC plumes. Thirteen wells (MW-6, MW-7, MW-8, MW-9, MW-11, MW-13, MW-14, MW-31, MW-47A, MW-48B, MW-59, MW-81A, and MW-89A) located within or surrounding the VOC plumes were screened at or near the bottom of the LS aquifer, where DNAPLs would be expected to be encountered. Field observations and analytical results do not indicate the presence of DNAPLs in the plume areas. Shallow wells within the plume areas also do not indicate the potential presence of DNAPLs. Numerous well clusters in the southern portion of the site downgradient of the major VOC plumes monitor all or almost the entire saturated thickness of the LS aquifer. Field observations and analytical results at these wells do not indicate the potential presence of DNAPLs. Well clusters that monitor both the LS aquifer and the bedrock aquifer are distributed over the entire site. Field observations and analytical results at these wells do not indicate the possible presence of DNAPLs.

Historical site uses indicate the potential presence of DNAPLs at the former Arsenal; however, physical site-characterization data indicates that free product DNAPLs were not encountered in the soil and groundwater at the former Arsenal.

6.5 BACKGROUND AND SITE GROUNDWATER QUALITY DEGRADATION

Water quality for a significant portion of the former Arsenal is degraded to the point that is does not meet drinking water standards. Most of this degradation is due to natural causes and conditions. Overpumping of regional aquifers has contributed to salt-water intrusion of the Farrington Sands. The groundwater in portions of the southern hydrologic zone of the former Arsenal does not meet NJDEP Class IIA drinking water standards primarily because of its natural salinity, iron and manganese. The groundwater sampled at background locations exhibited evidence of chemical contamination, including arsenic and VOCs (TCE, PCE and total 1,2-DCE). During the Phase 2 RI, water quality parameters were evaluated and compared to the NJDEP GWQS as cited under N.J.A.C. 7:9-6, January 7, 1993. The following sections present the results of this evaluation.

6.5.1 Background Groundwater Degradation

Four monitoring well clusters (MW-74B/C, MW-103A/C, MW-104A/C and MW-105A/C) and MW-82A were installed for the purposes of evaluating background groundwater quality. Each of these wells was sampled twice for TCL parameters. WESTON sampled 119 monitoring wells during the Round 1 sampling event for metals analysis, with two-thirds of the wells sampled for PPM and one third of the wells for TAL metals. PPM analysis consists of 13 metals including antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. These 13 metals are also included in the USEPA TAL metal analysis. The ten remaining metals included in the TAL analysis are aluminum, barium, calcium, cobalt, iron, potassium, magnesium, manganese, sodium and vanadium.

Bedrock water quality results, based on these four background bedrock wells are generally consistent. VOCs, SVOCs, pesticides and PCBs were not detected at concentrations exceeding the GWQS, except for one SVOC compound (bis[2-ethylhexyl]phthalate), which was attributed to laboratory contamination. Bedrock monitoring well MW-103C was the only background bedrock well that was analyzed for TAL metals. The bedrock metal results indicate that iron exceeds the GWQS of 300 ug/L in MW-103C (824 ug/L). Manganese was detected above the GWQS of 50.0 ug/L in MW-103C (55.0 ug/L). Sodium was detected below the GWQS of 50,000 ug/L in MW-103C (42,400 ug/L). Potassium was detected at a concentration of 5,790 ug/L in MW-103C; however, there is no GWQS for this compound. TDS was detected below the GWQS of 500,000 ug/L in MW-103C (218,000 ug/L). Sulfate and chloride were not analyzed during the Phase 2 RI.

Background concentrations of iron, manganese and potassium can be attributed to natural background bedrock water quality conditions. Sodium and TDS are elevated within background bedrock wells based on results from MW-103C (42,400 ug/L for sodium) and field salinity and conductivity measurement. It is believed that the source of the high sodium and TDS levels is the result of historic salt water intrusion. In addition, other analytes (i.e., aluminum, calcium and magnesium) were not detected in the other background wells since these wells were sampled for PPM and not TAL metals. Aluminum, calcium and magnesium are considered to be notable anomalies and indicative of a trend of naturally high concentrations of metals due to regional characteristics of the Triassic Passaic Formation.

Overburden water quality results, based on five background overburden wells (MW-74B, MW-82A, MW-103A, MW-104A and MW-105A) indicate reasonably comparable results. Several organic compounds were detected in two of the shallow background overburden monitoring wells north of the site (MW-103A and MW-105A). TCE, PCE and total 1,2-DCE were detected in both rounds of sampling at levels that exceeded the applicable groundwater quality standards. All three VOCs were detected in MW-103A, while only TCE was detected in MW-105A. The VOC compounds associated with MW-103A have been designated ~~AOC offsite~~ 1 (Figure 5-1) as presented in Section 6.1.1. TCE associated with MW-105A has been designated ~~AOC offsite~~

(Figure 5-1) due to the fact that the plume originates from an off-site location and is attributable to background conditions. Organic compounds were not detected at concentrations exceeding the GWQS in any of the groundwater samples collected at the MW-74B, MW-82A and MW-104A wells. These off-site plumes of VOC contaminants have contributed to the degradation of the LS overburden aquifer, which underlies the former Arsenal. Potential source areas for these VOC plumes are discussed in Section 6.7.

SVOCs, pesticides and PCBs were not detected at concentrations exceeding the GWQS in the background overburden wells. MW-82A was the only overburden background monitoring well analyzed for TAL metals. Manganese was detected above the GWQS of 50.0 ug/L at background well MW-82A, with a concentration of 2,540 ug/L. Potassium which does not have a GWQS was detected at a concentration of 2,580 ug/L at MW-82A. TDS was detected below the GWQS of 500,000 ug/L at MW-82A, with a concentration of 78,000 ug/L. Sulfate and chloride were not analyzed during this Phase 2 RI. Background levels of manganese and potassium are high and can be attributed to natural background quality conditions. Iron in background wells was not detected over the GWQS; however, iron is pH and oxygen sensitive as documented by Langmuir, 1969, who states "the greatest concentration of ferrous iron in the study area occurred in zones of... confined or semi-confined conditions". Based on a review of the analytical results, generally, higher iron concentration are detected in the southern portion of the former Arsenal where semi-confining conditions are present. Sodium and TDS are elevated (but below the GWQS) within the overburden wells. The source of the high sodium and TDS levels is the result of natural background conditions.

It is evident from samples collected from these background monitoring wells that the groundwater upgradient from the former Arsenal (both the overburden and bedrock hydrologic zones) will migrate in a south-southeasterly direction towards the site and most likely contribute to the degradation of the groundwater quality on site. The contaminants detected are from both natural and industrial sources and must be considered when evaluating the on-site groundwater quality.

6.5.2 Site Groundwater Quality Degradation

The Phase 2 RI groundwater sampling events included 119 monitoring wells during Round 1 and 67 wells during Round 2. The total number of on-site wells sampled during Rounds 1 and 2 included 113 and 61 wells respectively, with six background wells sampled during each round. All groundwater samples were analyzed for TCL parameters and either PPM or TAL metals.

On-site groundwater sampling has indicated the presence of seven distinct plumes of VOC contamination (Figure 5-1). TCE, PCE and 1,2-DCE were the main VOC contaminants of concern identified in groundwater during the Phase 2 RI. Other VOCs detected at concentrations exceeding the GWQS included 1,2-DCA, benzene, chlorobenzene, dichlorobromomethane and vinyl chloride. A total of 23 overburden monitoring wells indicated one or more of these VOCs at concentrations exceeding the GWQS. Most of the elevated VOC concentrations were detected in groundwater samples collected from the northern hydrologic zone. The most recent development and industrial activity within the former Arsenal has taken place in this portion of the site (Raritan Center). Therefore, these areas are more likely to contain potential non-DOD source areas for these plumes. Bedrock monitoring wells do not indicate any VOC contamination. In addition, 10 metals were detected site-wide at concentrations exceeding the GWQS. These metals included aluminum, antimony, arsenic, cadmium, chromium, iron, lead, manganese, sodium and nickel; of which iron, manganese and sodium have been determined to be of natural background quality. There appears to be a correlation between some of these analytes and areas known to contain dredge spoils.

Analysis of TDS was performed at 26 on-site monitoring well locations. The NJDEP GWQS for TDS is 500 mg/L. The groundwater sampling results indicated that 12 of the 26 locations had TDS levels that exceeded the GWQS, with concentrations that ranged from 620 mg/L to 19,000 mg/L. Salinity was also measured during the well development and purging activities, prior to well sampling at the former Arsenal. There was a good correlation between TDS and salinity site-wide.

The entire southern portion of the site (i.e., the entire southern hydrologic zone) indicated levels of salinity that exceeded the 0.5 ppt GWQS. The salinity concentrations in the overburden groundwater samples ranged from 0.5 ppt to 17.0 ppt, while those for the bedrock wells (in the southern zone) ranged from 2.4 ppt to 12.0 ppt. This information confirms the 1984 through 1985 groundwater investigation performed by USACE/Malcolm Pirnie for land disposal of dredge material, which concluded "The groundwater quality based on this evaluation does not meet drinking water standards, primarily as a result of natural conditions. Salinity ranged from 1 to 12 ppt in November and December 1984, with most values 2 ppt or greater, as would be expected in the water of a brackish marsh system" (Schmid, 1987).

Based on a USACE/Malcolm Pirnie Evaluation of land disposal of dredge material, a groundwater evaluation was performed in 1984 and 1985. Fourteen groundwater monitoring wells were located in the southwestern portion of the former Arsenal in the tidal marsh areas of Areas 11, 16 and 19. The groundwater elevations of the water table (potentiometric surface) increased from the river and ditches toward the interior of the site, giving rise to a flow toward the river and drainage ditches. The groundwater quality, based on this evaluation, did not meet drinking water standards, primarily as a result of natural conditions. Salinity ranged from 1.0 ppt to 12.0 ppt in November and December 1984, with most values 2.0 ppt or greater, as would be expected in the water of a brackish marsh system. The water was slightly acidic (pH range 5.8 to 6.6). Iron concentrations exceeded the 0.3 mg/L criterion for drinking water in all results except four of the September 1985 wells sampled, exceeding 100 mg/L in two wells. Manganese concentrations consistently exceeded the 0.5 mg/L drinking water criterion and reached a maximum of 15.6 mg/L. Sulfate, chloride, and dissolved solids concentrations were typically in excess of drinking water standards, but were within the expected range for tidal marshes (Schmid, 1987).

Hardness information was collected during the Phase 2 RI during Round 1 at the 26 locations analyzed for TAL metals. The NJDEP GWQS for hardness is 250 mg/L. Hardness results at 10 of the 26 locations exceeded the GWQS, with concentrations that ranged from 320 mg/L (MW-26) to 7,760 mg/L (MW-90C). At 16 of the 26 locations, hardness was detected below the GWQS, with concentrations that ranged from 33.8 mg/L (MW-EPA2A) to 242 mg/L (MW-61).

Based on a review of the natural aquifer conditions that effect groundwater quality in the overburden and bedrock aquifers, groundwater in the overburden aquifer in the southern portion of the former Arsenal is not of potable quality (meeting the NJDEP requirements for a Class IIA aquifer) based on the natural concentrations for salinity and TDS.

6.6 PAST, PRESENT AND FUTURE USES OF GROUNDWATER

6.6.1 Past Usage of Groundwater

According to Schmid (1987), groundwater was not historically utilized at Raritan Center. Overpumping of regional aquifers, which are important industrial and public sources in municipalities south of the study area, has caused saltwater intrusion into regional wellfields. At Raritan Center, groundwater does not meet drinking water standards, primarily because of its natural salinity, iron, manganese and sulfate concentrations. Adequate public water supplies are available for future development in the study area from the off-site surface and underground supplies tapped by Middlesex Water Company. Water lines at Raritan Center have been constructed in sizes to accommodate full development.

6.6.2 Present Usage of Groundwater

The WESTON evaluation of the water usage within the borders of the former Arsenal confirms the information presented in the Schmid report. The review of water use information was based on a NJDEP, Bureau of Water Allocation file search of all wells within a two and five-mile radius of the site. A summary of the well locations, uses and total well numbers identified from the January 1993 NJDEP two-mile radius file search is presented in Appendix C, Water Usage Survey, Table 1. The search yielded a total of 874 wells which were permitted. The wells were categorized into three types:

- Monitoring wells, piezometers, vapor extraction wells, recovery wells and test borings located within the site boundaries, including any domestic, industrial, or public supply wells identified within a one-quarter mile of the site.

- Monitoring wells, piezometers, vapor extraction wells, recovery wells and test borings located outside the site boundaries, including any domestic, industrial, or public supply wells identified within a greater than one-quarter mile of the site.

- Any wells located south of the Raritan River.

The results of this evaluation, including conversations with the Edison Health Department and a supplemental field reconnaissance indicated the following:

- Five potential domestic wells were identified within one quarter mile of the site. All of these wells have been confirmed to be out of service based on a WESTON field inspection. In addition, these five locations are located upgradient of the former Arsenal. Other potential receptors were not identified within the site boundary or within one quarter mile of the site.

- Nineteen domestic wells, 14 industrial wells and one public supply well were identified greater than one quarter mile from the site. Many of these wells are believed to be out of service; however, this has not been confirmed and verification is required. In any case, these wells are located upgradient or sidegradient of the site and are not expected to impact the former Arsenal.

- Thirty-seven potential receptors located south of the Raritan River are not expected to impact the Phase 2 RI. Since the Raritan River is a regional groundwater discharge waterway, potential receptors south of the Raritan River would affect the river, not the former Arsenal.

- Although 61 water withdrawal points (permitted for pumping up to 100,000 gallons per day) are reported within five miles of the approximate center of the site, it is not likely that these wells would impact the former Arsenal overburden and bedrock aquifers. These offsite water withdrawal points do not appear to be affecting local groundwater flow patterns.

- A significant number of industrial facilities exist in and near the Raritan Arsenal for which monitoring well permits exist. These facilities represent potential sources of groundwater contamination which could impact the former Arsenal.

Based on this information, there are no human receptors for the groundwater (overburden or bedrock) at the former Arsenal.

6.6.3 Future Usage of Groundwater

Based on conversations with the Edison Health Department there are no future use plans for the groundwater (both overburden and bedrock) within the former Arsenal. The past history of salt-water intrusion, TDS, iron and manganese problems are the principal reasons why the township has not developed these aquifers.

6.7 POTENTIAL NON-DOD SOURCES OF CONTAMINATION

The results of the preliminary evaluation of potential non-DOD sources of soil and groundwater contamination are discussed below. This evaluation was based on a limited land use survey; a review of data obtained from the NJDEP, USEPA, and local health department files related to past or current RIs or cleanups; the NJDEP list of "Known Contaminated Sites in New Jersey". The USEPA "CERCLIS" List for Region II; and the NJDEP "Alpha Listing" of Registered Underground Storage Tanks for Middlesex County. In addition, analytical results of Phase 2 RI groundwater sampling were evaluated to determine if off-site sources of groundwater contamination are migrating onto the former Arsenal.

Based on the limited surrounding land use survey, 15 facilities within or adjacent to the former Arsenal were evaluated to determine if they are potential sources of non-DOD soil and groundwater contamination. Of these 15 sites, two (Ardmore Textured Metals Inc., and Inland Container Corp.) are located within the boundaries of the former Arsenal. The remaining 13 sites are located adjacent to the former Arsenal. Five of the 15 sites, including Tenneco Chemicals (a.k.a. Nuodex Inc.), Industrial Land Reclaiming (ILR Landfill), former Fedders Facility (New York Times), Ardmore Textured Metals Inc., and Inland Container Corporation, are located either upgradient or sidegradient to groundwater flow direction at the former Arsenal. These five sites could potentially contribute to groundwater contamination at the former Arsenal. Detailed discussions of each of the 15 sites reviewed are presented in Appendix D.

Based on the review of the NJDEP SRP Report "Known Contaminated Sites in New Jersey", 1994, street addresses, a total of 151 active and pending sites were identified within Edison (88) and Woodbridge (63) Townships. Fourteen of the 151 sites are located within the boundaries of the former Arsenal. The remaining 137 sites are located outside the boundary of the former Arsenal. Nineteen of the 131 sites are located adjacent to the site boundary and are positioned either upgradient or side gradient to groundwater flow. The exact location and nature of potential contamination at these sites were not established during this review. In addition, field verification and inspection will be required. However, many of these sites have the potential to impact the soil and/or groundwater at the former Arsenal and are located in areas where groundwater contamination was identified. In order to evaluate the potential impacts of these sites, a more detailed file review and survey is required. Table 6-3 presents a summary of known contaminated sites within or adjacent to the former Arsenal. The approximate locations of the 14 sites within the boundary of the site are shown on Figure 6-1. Locations of the sites outside the site boundary are not shown and locations not identified on Figure 6-1 are a result of low confidence or no street address available.

Based on the review of the USEPA "CERCLIS" list, street addresses, a total of 23 sites were identified within or adjacent to the former Arsenal. Eight of the 23 sites are located within the boundary of the former Arsenal. The remaining 15 sites are located either upgradient or side gradient to groundwater flow direction. The exact location and nature of potential contamination at these sites was not determined during this review. In addition, field verification and inspection will be required. In order to evaluate the potential impacts of these sites, a more detailed file review and survey is required. Table 6-4 presents a summary of USEPA CERCLIS sites within or adjacent to the former Arsenal. The approximate locations of the eight sites within the boundary of the former Arsenal are shown on Figure 6-1. Locations of sites outside the site boundary are not shown and locations not identified on Figure 6-1 are a result of low confidence or no street address available.

Based on a review of the NJDEP "Alpha Listing" of Registered Underground Storage Tanks in Middlesex County, street addresses, a total of 45 registered underground storage tanks are located within the boundaries of the former Arsenal. For the purposes of this evaluation, only tanks located within the boundary of the former Arsenal are discussed. Most of the tanks are located in Raritan Center within or adjacent to AOCs. Several are located upgradient of AOCs or within the USEPA facility (GSA Raritan Depot), Middlesex County College, and Thomas A. Edison County Park. Each of the tanks has the potential to impact soil and groundwater at the former Arsenal. Since the exact location, contents and analytical results of soil and groundwater sampling (if any) in the vicinity of these tanks has not been established, the potential impacts to soil and groundwater can not be evaluated at this time. In addition, field verification and inspection will be required. In order to evaluate the potential impact of these tanks to the soil and groundwater at the former Arsenal, a more detailed file review and survey is required. Table 6-5 presents a summary of registered underground storage tanks within the former Arsenal. The approximate locations of the 45 tanks are shown on Figure 6-1. Eight of the tank locations could not be determined based on the addresses given on the list. These eight tanks are not shown on the figure.

Based on a review of groundwater flow direction and analytical results of groundwater samples collected during the Phase 2 RI, off-site sources of groundwater contamination have been identified. These off-site sources of groundwater consist of two distinct groundwater plumes and include the following:

- Based on the results of the SGWS investigation and groundwater sampling during the Round 1 and 2 sampling events, VOCs including TCE, total 1,2-DCE and PCE were detected at concentrations that exceed the NJDEP GWQS in the vicinity of upgradient background monitoring wells MW-40 and MW-103A (Figures 5-2, 5-3 and 5-4). Based on the analytical results and groundwater flow directions, a plume of VOCs is flowing onto the former Arsenal. This plume is not associated with past activities at the former Arsenal.

- Based on the results of the SGWS investigation and groundwater sampling during the Round 1 and 2 sampling events, TCE was detected at concentrations that exceed the NJDEP GWQS in upgradient background monitoring well MW-105A (Figure 5-2). The source of this potential plume has not been determined, but based on the location of the well and groundwater flow directions, a potential VOC plume is flowing onto the former Arsenal. However, this cannot be confirmed until groundwater sampling in Area 18A is performed. Based on an initial evaluation of data, it is not likely that this potential VOC plume is associated with past activities at the former Arsenal.

- Based on the results of the Round 1 and 2 of groundwater sampling events, TCE was detected at concentrations that exceed the NJDEP GWQS in monitoring well MW-91A located in the southwestern portion of Area 16 (Figures 5-2 and 5-22). This result is inconsistent with the groundwater sampling for other monitoring wells in Area 16 located to the north, east and south. Based on historical data, the analytical results of surrounding wells and groundwater flow direction; the most likely source of contamination at this location, is the former Tenneco Chemical site or the ILR landfill rather than past activities at the former Arsenal.

SECTION 7.0

CONCLUSIONS AND RECOMMENDATIONS

7.1 PHYSICAL SITE CHARACTERIZATION

The results of the Phase 2 RI investigation indicate that most of the southern two thirds of the former Arsenal consists of a lowland estuarine environment, while most portions of the northern third of the site are either developed or palustrine (freshwater) forested and emergent wetlands. The site topography slopes gently east-southeast towards the Raritan River. Ground surface elevations range from six feet MSL to approximately 100 feet MSL.

The site geology is characterized by an overburden layer, approximately 10 to 80 feet thick, composed of unconsolidated sediments underlain by a bedrock composed of shales, metamorphosed shales and an igneous diabase sill. Specifically, the subsurface materials are grouped into the following units, starting at ground surface:

- The Upper Sand (US) unit consists of reworked natural material, dredge spoils and fill of varying composition. The US unit is limited in extent and thickness and is found predominantly in the southern, south central and north central portions of the site. The US unit is not considered an aquifer. The zone of saturation in the US unit is thin, discontinuous and perched where underlain by the meadowmat.

- The Meadowmat (MM) unit consists of organic-rich silt and clay. The MM (formerly identified as peat) was the marsh surface prior to development in the region. The MM is discontinuous across the site, occupying the southern hydrologic zone of the former Arsenal. The MM unit is not an aquifer, but is characterized as a semi-confining unit (due to its low permeability) where present over the LS unit.

- The Lower Sand (LS) unit consists of fine-grained to coarse-grained sand with some gravel and occasional clay lenses. The LS unit is continuous across the site and, regionally, is part of the Farrington Sand Formation. The LS unit is the primary overburden water-bearing unit beneath the site. The LS unit is found unconfined in the northwestern portion of the site and confined, to varying degrees, where it is overlain by the MM in the eastern-southeastern portions of the site.

- The Weathered Bedrock (WBK) group consists of a dense, discontinuous clay unit, the Raritan Fire Clay, the weathering products of the shale and saprolite deposits associated with diabase bedrock. The WBK group is present throughout most of the former Arsenal, but is absent in the southern and southwestern portions of the site where it has been eroded by past meanderings of the Raritan River. The WBK group is not an aquifer, but is considered a semi-confining layer (due to its low permeability) atop the bedrock aquifer.

- The competent bedrock beneath the site consists of Triassic age shale (Passaic Formation) under the north-northwestern portion of the site; a metamorphosed shale (slate) in the central portion, and an igneous diabase sill (Palisades Sill) in the south-southeastern portion of the site. The bedrock strikes northeast and dips gently towards the northwest. The shale and metamorphosed shale have numerous fractures, while the diabase sill has relatively few fractures. The bedrock is a semi-confined aquifer, with groundwater occurrence and movement predominantly in the fractures.

The site groundwater hydrology is characterized by separate aquifers in the overburden and bedrock. Groundwater within the overburden and bedrock aquifers flows southeastward across the site toward the Raritan River. For the purposes of evaluating the hydrological trends and interpreting the relationship between these trends and the site geology, the former Arsenal was divided into northern and southern hydrologic zones.

The LS unit is the primary water-bearing unit within the overburden and exhibits both confined and unconfined conditions. In the north-northwestern portion of the site, the LS unit is unconfined and the water table mirrors the surface topography. In the south-southeastern portion of the site, the LS unit is confined by the MM and the piezometric surface is almost flat. The average horizontal hydraulic gradient for the northern zone was 0.0090 feet/feet, while for the southern zone was 0.0011 feet/feet. The average vertical hydraulic gradient within the overburden is 0.0797 feet/feet downward.

The bedrock aquifer is confined by the WBK group and saprolite deposits overlying the Palisades Sill, and the bedrock fracture system controls the occurrence and movement of groundwater. The average horizontal hydraulic gradient within the bedrock aquifer is 0.007 feet/feet, while the average vertical hydraulic gradient between the overburden and bedrock aquifers is 0.0116 feet/feet downward. These hydraulic gradient values suggest the potential for groundwater movement downward from the overburden aquifer into the bedrock aquifer. However, it should be noted that two of the three groundwater elevation measurement rounds were conducted during high tide, when groundwater levels in the overburden would be elevated in comparison to the groundwater levels in the bedrock, resulting in a greater vertical hydraulic gradient. In addition, the bedrock aquifer is essentially uncontaminated, indicating no downward movement of contaminants into this aquifer. These factors indicate that the predominant groundwater flow vectors in both the overburden and bedrock aquifers are horizontal.

The tidal influence investigation indicated that groundwater levels in both aquifers are influenced by tidal fluctuations. Groundwater levels in the overburden aquifer were affected by tidal influence to a greater extent than the bedrock aquifer. However, water level fluctuations due to tidal influence had no significant effect on groundwater flow direction in either the overburden or bedrock aquifers.

The interrelationship between surface water and groundwater is limited to the overburden aquifer and varies between recharge and discharge modes according to locale and site conditions such as tidal cycle and precipitation events. Overall, both surface water and groundwater (overburden and bedrock) ultimately discharge to the Raritan River.

7.2 POTENTIAL GROUNDWATER CONTAMINANTS OF CONCERN

7.2.1 Background Contaminants of Concern

As part of the Phase 2 RI activities, nine monitoring wells (five overburden and four bedrock) were installed upgradient of the former Arsenal to evaluate background groundwater quality. Analysis of background groundwater samples indicate concentrations of iron and manganese exceeding the NJDEP Class IIA GWQS. Iron and manganese are naturally occurring compounds. Potassium was detected in overburden and bedrock background monitoring wells at concentrations ranging from 2,580 ug/L to 5,790 ug/L. Potassium is considered to be a naturally occurring compound with no GWQS established by the NJDEP. Sodium was detected in background wells at concentrations ranging from 2,540 ug/L to 42,400 ug/L, below the NJDEP GWQS of 50,000 ug/L. Sodium is a naturally occurring compound. Sodium in bedrock is believed to be a result of historic saltwater intrusion of the bedrock. Further evaluation of these compounds is not warranted based upon their presence within the upgradient background monitoring wells.

Two of the four overburden, background wells contained PCE, TCE and total 1,2-DCE at concentrations exceeding the Class IIA GWQS. These results indicate that a portion of the on-site VOC groundwater contamination may be attributed to off-site sources.

7.2.2 On-Site Contaminants of Concern

The analytical results from two rounds of monitoring well sampling and the shallow groundwater screening investigation indicate that organic and inorganic contamination exceeding NJDEP GWQS is present within the overburden aquifer. The analytical groundwater results also indicate that the bedrock aquifer is essentially uncontaminated.

Organic contaminants of potential concern include benzene and the chlorinated VOCs TCE, PCE, 1,2-DCA, 1,2-DCE, chlorobenzene, and vinyl chloride. Based on an evaluation of OBG, Dames & Moore, and Phase 2 RI groundwater analytical results, the VOCs are generally found in seven plumes in the overburden aquifer beneath the north-north central portions of the site. The VOC plumes are moving very slowly proportional to the hydraulic conductivity value reported by OBG in 1989 (60 to 2,600 gal/day/ft^2) and the hydraulic gradient measured during the Phase 2 investigation (0.0055 foot/foot). The slowing of the VOC plumes is caused by retardation, natural attenuation, and degradation of dissolved compounds. A pure phase solubility evaluation was conducted on all monitoring well and shallow groundwater screening analytical results. The evaluation indicated that only one location (SGW-110) had a VOC concentration greater than a one percent pure phase solubility limit. Therefore, the presence of free-phase DNAPLs within aquifers at the former Arsenal is unlikely.

Inorganic contaminants of potential concern include aluminum and arsenic. These metals of concern were predominantly found in the southern portion of the former Arsenal. Aluminum was observed site-wide at concentrations exceeding the NJDEP GWQS, with exceedances in both overburden and bedrock wells. Aluminum concentrations in bedrock wells was an order of magnitude less than aluminum concentrations in overburden wells. Based on the widespread distribution of aluminum, plumes cannot be delineated or attributed to point sources. However, analytical groundwater results indicate that higher aluminum concentrations appear to be associated with the Black Ditch and Red Root Creek Drainage Areas. Arsenic was detected at concentrations exceeding the GWQS throughout the overburden monitoring wells in the southern portion of the former Arsenal. Arsenic was not detected at concentrations exceeding the GWQS in any bedrock wells at the former Arsenal. Arsenic exceeded the GWQS in monitoring wells located in Areas 4, 5, 6, 6A, 6B, 11, 14 and 16 and cannot be delineated into specific plumes. Contributing sources of aluminum and arsenic may include historic fill used in the construction of former Arsenal infrastructure, the application of sodium arsenite herbicide at the former Arsenal, the deposition of dredge spoils, non-DOD sources, or the effects of the Raritan River.

The analytical groundwater results indicated sodium (and salinity) at concentrations exceeding the NJDEP GWQS within the overburden and bedrock aquifers throughout the lower two thirds of the former Arsenal. The elevated sodium (and salinity) present within the groundwater can be attributed to saltwater intrusion of the Raritan River, a tidally-influenced estuary.

7.3 RECOMMENDATIONS FOR FURTHER INVESTIGATION

The former Arsenal site and adjacent areas have experienced 32 years of extensive construction, development, industrial/commercial activities and other uses since the Raritan Arsenal was closed in 1963; extending the potential sources of contamination substantially beyond historical DOD source areas. In addition, the compounds of potential concern which have been identified as a result of the Phase 2 RI (benzene, PCE, TCE, 1,2-DCA, total 1,2-DCE, chlorobenzene, vinyl chloride, aluminum and arsenic), are common contaminants found within many industrialized and developed areas of New Jersey.

It is recommended that the following general investigations be carried out prior to any further widescale investigation of AOC at the former Arsenal. The purpose of these proposed activities will be to determine whether the contaminants of concern pose an unacceptable environmental risk and to what extent they are attributable to past DOD activities at the site; while generating sufficient additional documentation to support reclassification of the overburden aquifer in the southern part of the site due to naturally caused water quality degradation.

- Results of a 1988 study by McLaughlin suggest that background levels of contaminants such as lead in the Raritan River may potentially contribute to surface water concentrations of these metals in tidally-influenced areas of the former Arsenal. Surface water and sediment should be sampled within the Raritan River, both upstream and downstream of the former Arsenal site to ascertain background levels of metals and other contaminants. This should be done over a complete tidal cycle. This information will support a comparison of groundwater contaminants to those in the receiving surface water body and could also be used in the future to make decisions about AOCs within tidally affected areas, since the Raritan River may be a continuing source of contamination at these locations.

- Development activities and plans for the Raritan Center Industrial Park and other areas within the former Arsenal should be identified. Decisions related to future investigation and potential remediation at the former Arsenal should take these plans into consideration, as construction activities undertaken during and following the completion of the groundwater investigation have resulted in further alteration of site hydrology and have potentially affected contaminant migration and transport. Examples of such activities include filling the Area 20 Ditch and construction of impermeable building and parking lot coverage over Area 20, wetland creation/mitigation activities in the northeastern portion of Red Root Creek and ongoing fill activities in Area 14.

- Due to 32 years of non-DOD activity at the former Arsenal and the potential for off-site sources to contribute to the observed contaminant levels in groundwater, further evaluation of contaminant source areas is required. This task should include a thorough file review and site inventory and survey related to non-DOD site activities. A preliminary identification of potential non-DOD sites potentially contributing contaminants to the former Arsenal is presented in this report. A more detailed identification of the past and current industries which could be contributing to groundwater contamination should be conducted, as very limited information has been provided by landowners or Edison Township officials. As recommended in the draft ROI for the Area 14 soil investigation, additional research is required to determine the exact nature and circumstances related to the historical dredging/filling operations which have impacted Areas 11, 12, and 14. The results of this research will determine whether dredge areas qualify under DERP guidelines for DOD-lead remediations.

- Phase 2 RI data collected by WESTON indicates that the overburden aquifer does not meet the requirements of a Class IIA aquifer in the southern portion of the former Arsenal, based on the TAL metals analyses and salinity results. Collection of two additional rounds of water samples from selected wells in the southern portion of the site for chloride, TDS and other appropriate groundwater quality indicators is recommended to support an application to the NJDEP to reclassify the southern portion of the site as a Class IIIB aquifer. Unlike the Class IIA aquifer designation currently in effect for the site, a Class IIIB designation would denote that the natural quality of the groundwater is not suitable for conversion to potable uses and would reduce the level of concern for contaminants in the applicable part of the site. This aquifer designation has previously been applied to locations on the southeastern shore of the Raritan River, opposite the former Arsenal. Reclassification of the aquifer from a Class II A to a Class III B will be consistent with NJDEP regulations pursuant to N.J.A.C. 7:9-6.5(f)3 and 4 of the Ground Water Quality Standards and the applicable Surface Water Quality Standards (N.J.A.C. 7:9b-1 et seq.)

- Although the northern portion of the former Arsenal is classified as a Class IIA aquifer and contamination exceeding GWQS has been documented, groundwater is not used for potable or industrial purposes. NJDEP regulations include a provision for the designation of areas of exception to strict application of the GWQS in certain, specific situations. These circumstances are identified under N.J.A.C. 7:9-6.6, which states that the Department may designate an aquifer classification exception area (CEA) only when constituent standards are not or will not be met due to (1) natural groundwater quality; (2) localized effects of a permitted discharge (e.g., effluent limits above the constituent standards with a discharge outside the plume/capture zone); (3) part of a pollution remedy conducted pursuant to an ACO or other Department oversight mechanism or program; or (4) an Alternate Concentration Limit approved pursuant to the New Jersey Pollutant Discharge Elimination System (NJPDES). The northern portion of the former Raritan Arsenal may qualify as a CEA and it is recommended that this option be evaluated as part of the future management of the site. This recommendation is based on the fact that there is no current or future use of groundwater. The entire former Arsenal is on public water, and there are no human receptors. Lastly, the Phase 2 RI has clearly determined that there are off-site sources of groundwater contamination not attributed to the Army.

- Some wells installed as part of previous investigations are screened across multiple geologic and hydrologic units (such as the US, MM, LS) with screen lengths of over 20 feet. These wells are located within VOC plumes increasing the potential for cross-contamination of the US and LS units. A detailed evaluation of these wells is recommended to determine whether the wells should be grouted. The need for a properly screened well at each location should be incorporated into the evaluation. It is recommended that monitoring well MW-31 be grouted as a priority. MW-31 is not double cased and is located near a VOC plume associated with Areas 1 and 18A. This well's screen deeply penetrates the Raritan Fire Clay and the well should be sealed to preclude the possibility of contamination migrating to the bedrock aquifer.

- Based on the evaluation of surface water and groundwater elevations, it appears that groundwater discharges to surface water in some portions of the former Arsenal.

Therefore, contaminants present in groundwater may be impacting surface water and sediments. Sampling of the Raritan River and other reference locations has been recommended to assist in the evaluation of surface water and groundwater contaminants of concern. It has been shown that there are no human receptors for groundwater at the former Arsenal. If it appears that groundwater, surface water or sediment contaminants are present at the site at concentrations exceeding reasonable "background/reference" levels, and are attributable to historical DOD activities, then a tiered ecological risk assessment should be initiated in order to further evaluate the potential toxicity of compounds of concern. The purpose of the first tier or phase of this risk assessment would be to evaluate existing levels of a select group of contaminants to determine if aquatic biota are at risk. Total and dissolved metals analyses should be conducted for any future surface water sampling, to determine whether metals present in the surface water adsorbed to suspended solids in the water column, or present in the dissolved state. If the first tier results were inconclusive or predicted adverse effects, then the objective of the second tier would be to conduct appropriate site-specific studies to test or further resolve the extent of ecological effects posed by contaminants, and to ultimately establish site-specific cleanup levels for contaminants of concern.

7.3.1 Specific Areas of Potential Concern Requiring Further Investigation

Specific potential AOCs for groundwater and conclusions and recommendations regarding them are described below. Except for additional investigations related to the Work Plan Addendum or unfinished Area 5 and Area 12 sampling, further investigation of AOCs will be contingent upon the results of the general investigations proposed above.

SGWS was conducted at over 150 locations during the Phase 2 RI to evaluate shallow groundwater quality as related to potential VOC contamination. As discussed in Section 6.1.1 through 6.1.7; the VOC analytical results of the SGWS investigation correlated well with the analytical groundwater VOC results for monitoring wells, generating a high level of confidence in the use of the Geoprobe sampling method for additionally required groundwater sampling.

The installation of additional wells in specific areas of concern will be performed based on the results of the DOD and non-DOD source area survey. VOC plumes that can be determined to be DOD related, will be evaluated. Additional overburden monitoring wells will be added to support a clearly defined specific purpose (such as aquifer reclassification or to refine the well array for natural attenuation as a remedial option). In areas of groundwater contamination not attributed to DOD activities, additional groundwater monitoring will not be performed, consistent with DERP guidelines. Recommendations for new monitoring wells and resampling of existing wells will be presented in the Proposed Remedial Action Work Plan for groundwater.

- The groundwater plume AOC 2 contains VOCs which can be potentially attributed to both DOD and non-DOD sources. Additional soil sampling (test pits) at the suspected source area near Building 256 is planned as part of the Work Plan Addendum activities. Soil sampling may be supplemented with additional SGWS Geoprobe sampling. A thorough file search and industrial site inventory is recommended to investigate all potential sources of VOC contamination within AOC2, including the benzene contamination which does not appear related to Building 256 operations. Further groundwater sampling in this AOC is not recommended unless the Work Plan Addendum and file search investigations determine that the AOC 2 plume was created by DOD discharges. Any additional future groundwater monitoring of the AOC 2 plume should utilize Geoprobe sampling, plus sampling of existing wells.

- The groundwater plume AOC 3 (Owens-Illinois) contains VOCs which do not appear to be attributable to the former DOD aboveground tank farm. Additional groundwater sampling of wells near this area is proposed as part of the Work Plan Addendum activities. A file search and investigation of potential non-DOD operations is recommended to determine the source area for the contamination. Further Geoprobe SGWS sampling is recommended to more accurately localize the extent of this plume to determine whether it is related to the former tank farm, or to a non-DOD source.

- The groundwater plume AOC 4 contains VOCs which have been attributed to combinations of upgradient and DOD sources (former Area 18A pond). The analytical soil results within Area 18A indicate that there does not appear to be a major continuing point source discharge to groundwater. The absence of a point source can be attributed to the successful USACE remedial activities conducted to address the former pond area. As shown on Figure 5-1, AOC 4 is the largest VOC plume identified at the former Arsenal. However, the analytical results of bedrock monitoring wells MW-71C, MW-87C, MW-88C and MW-89C indicate that the bedrock aquifer remains uncontaminated. Additional groundwater and soil sampling in and near Area 18A has been proposed as a followup to the Phase 2 investigation of Area 18A and as part of the Work Plan Addendum activities. Two additional overburden wells (PW-41A and PW-42A) are to be installed and sampled as part of the Area 18C investigation. In addition, wells within Area 18 at locations upgradient to Area 18A will be sampled. A file search for upgradient sources of VOCs is recommended related to DOD or non-DOD activities. Any future groundwater monitoring of the AOC 4 plume should emphasize Geoprobe sampling, plus sampling of existing wells.

- The groundwater plume AOC 5 (Area 10 tennis courts) contains VOCs which may be attributable to potential DOD and non-DOD activities. A file search of AOC 5 to evaluate potential DOD and non-DOD contamination source areas is recommended. Further Geoprobe SGWS sampling is also recommended to more accurately localize the extent of this plume.

- The groundwater plume AOC 6 (Area 19) detected VOCs which have been attributed to potential DOD and non-DOD sources. A file search and industrial site inventory of surrounding areas is recommended to determine potential DOD and non-DOD sources of contamination. Further groundwater sampling in this AOC is not recommended unless the file search investigation determines that the AOC 6 plume was most likely created by a DOD discharge. Any additional future groundwater monitoring of the AOC 6 plume should emphasize Geoprobe sampling, plus sampling of existing wells.

- The groundwater plume AOC 7 (PSE&G) detected VOCs which have been attributed to potential DOD and non-DOD sources. Additional soil sampling is proposed in the Area 7 Draft ROI to evaluate potential source areas. Another round of groundwater sampling is recommended to monitor plume movement. A file search and review of past and present land use is recommended to evaluate potential DOD and non-DOD related sources.

- Arsenic was detected within Area 14 at concentrations exceeding the GWQS of 8.0 ug/L in three of nine locations sampled in during the Round 1 groundwater sampling event. In five of nine remaining locations, arsenic was detected below the GWQS. Arsenic was undetected at MW-50C with a detection limit exceeding the GWQS. The presence of arsenic within the soil/dredge material in Area 14 at concentrations exceeding NJDEP soil cleanup criteria is believed to be a potential source of the groundwater contamination within Area 14. The Phase 2 investigation indicates that the highest arsenic levels in groundwater underlying Area 14 may be confined to the relatively narrow and low-yielding MM unit in the upper portion of the overburden aquifer. It is recommended that MW-50 be resampled and that additional soil and shallow groundwater samples be collected in and near the MM unit to determine the fate and concentration of arsenic in the MM unit.

- Arsenic was detected above the GWQS at the former Arsenal during both the Round 1 and 2 groundwater sampling events. Arsenic is a site-wide contaminant of concern, distributed predominantly in the southern portion of the site within Areas 6, 6A, 6B, 11, 12, 14 and 16. Concentrations of arsenic above the GWQS ranged from 8.2 ug/L (MW-16) to 398 ug/L (MW-50). The source of arsenic in both the soil and groundwater at the former Arsenal is likely related to its natural occurrence in the geologic formation present on-site, deposition of dredge spoils, past DOD-related activities (herbicide application), or effects of the Raritan River. It is recommended that the impact of arsenic in groundwater be evaluated as part of the proposed reference sampling, aquifer reclassification and ecological risk assessment programs.

- Aluminum was detected above the GWQS in 25 of the 39 monitoring wells sampled. Only one of the upgradient background monitoring wells (MW-103C) was sampled for TAL metals (which includes aluminum). It is recommended that all the background wells be sampled for aluminum to determine background water quality for this metal.

- Explosive compounds were detected in monitoring wells MW-17 and MW-42A, located downgradient of Area 4. A SGWS investigation for explosive compounds (Method 8330) is recommended for the fenced portion of Area 4 to determine if potential soil contamination is impacting overburden groundwater quality.

- The groundwater investigation proposed for Area 18 in the Work Plan Addendum should be completed to determine the possible influence of contaminants from the USEPA and/or GSA on the former Arsenal. During this investigation, baseline groundwater quality upgradient and downgradient of the Area 18 should be determined.

- The Area 12 groundwater and soil investigation, as proposed in the Final Phase 2 RI Work Plan (December 1993) and subsequently amended, should be completed. The results of this investigation should be amended to the site-wide hydrologic report, as necessary.

7.3.2 Areas and Compounds Requiring No Further Action

- The bedrock aquifer remains unaffected after more than 60 years of DOD and non DOD activities at the location of the former Arsenal. Groundwater sampling information indicates some low levels of naturally occurring contaminants which can be attributed to natural background conditions, with the exception aluminum. Several SVOC were detected at one bedrock location, but this is attributed to laboratory contamination. In summation, the Raritan Fire Clay and Weathered Bedrock units in combination appear to be an effective barrier to contamination at this time. No further action for overall bedrock aquifer sampling is recommended.

- VOCs detected in AOC 1 can be attributed to an off-site source of contamination. MW-103 was designated as a background well cluster location, to determine groundwater quality entering the former Arsenal. Groundwater samples collected from monitoring well MW-103 detected VOCs emanating on-site from an off-site source. This contamination is attributed to non-DOD related activities. Further investigation is not recommended for this non-DOD related plume.

- The VOC dichlorobromomethane was detected in groundwater at concentrations exceeding the NJDEP GWQS. This VOC was detected at one location site-wide at a concentration exceeding the GWQS. Based on both the low frequency of detection and low concentration detected, this VOC is not considered a compound of concern at the former Arsenal. No further action is recommended for dichlorobromomethane in groundwater at the former Arsenal.

- Of the SVOCs detected in groundwater, only bis(2-ethylhexyl)phthalate was detected over the GWQS at the former Arsenal. Bis(2-ethylhexyl)phthalate exceeded the NJDEP GWQS at MW-67 (140 ug/L) and MW-90C (72 ug/L), two of the 119 locations analyzed. During the Round 2 sampling event bis(2-ethylhexyl)phthalate was not detected at concentrations exceeding the GWQS at any of the 67 wells sampled. Based on the analytical results, SVOCs are not of concern in groundwater at the former Arsenal. The presence of bis(2-

ethylhexyl)phthalate is most likely attributed to laboratory cross-contamination. Based on these occasional exceedances, SVOCs do not comprise a threat and no additional SVOC sampling should be performed on any former Arsenal wells. No further action is recommended for bis(2-ethylhexyl)phthalate or any other SVOC in groundwater at the former Arsenal.

- Metals such as antimony, cadmium, chromium, lead, mercury and nickel are not considered compounds of concern at the former Arsenal, based on their low frequency and distribution. Antimony was detected above the GWQS standard of 20 ug/L at three of the 119 locations during the Round 1 sampling event. During the Round 2 sampling event antimony was not detected above the GWQS. Cadmium was detected at the GWQS of 4.0 ug/L at one of the 119 locations during Round 1. During the Round 2 sampling event cadmium was detected at concentrations exceeding the GWQS in two of the 67 wells sampled. Chromium was detected above GWQS of 100 ug/L at one of the 119 locations sampled during Round 1. During the Round 2 sampling event chromium was not detected above the GWQS. Lead was detected above GWQS of 10.0 ug/L at six of the 119 locations sampled during the Round 1 sampling event. During the Round 2 sampling event lead was not detected above the GWQS. Mercury was detected above the GWQS of 2.0 ug/L at one of the 119 locations sampled during the Round 1 sampling event. During the Round 2 sampling event mercury was not detected above the GWQS. Nickel was detected above the GWQS of 100 ug/L at two of the 119 locations sampled during the Round 1 sampling event. During the Round 2 sampling event nickel was detected above the GWQS at one of the 67 wells sampled. The source of antimony, cadmium, chromium, lead, mercury and nickel is believed to be a combination of natural levels in the geologic formations underlying the former Arsenal, manmade discharges related to dredge spoils in the southern portion of the site, possible historic DOD activities at in the north central portions of the site (Areas 2, 3 and 4), and non-DOD sources. Except for the limited lead sampling proposed for Area 4 in Section 7.3.1, antimony, cadmium, chromium, lead, mercury and nickel are not considered to be a contaminants of concern at the former Arsenal and no further action with regard to these metals in groundwater is recommended.

- Metals such as iron, manganese and sodium, which occur naturally at elevated concentrations in background wells, should not be considered contaminants of concern at the former Arsenal. Therefore, no further action is recommended for iron, manganese and sodium in groundwater.

- Cyanide was not detected at any of the well locations sampled during either the Round 1 or 2 groundwater sampling events. Since cyanide was not detected site-wide, it is not considered to be a contaminant of concern and no further action is recommended for this compound in groundwater.

- Aldrin was the only pesticide detected in groundwater at the former Arsenal at concentrations exceeding the GWQS. Aldrin exceeded the GWQS at one of the 119 locations sampled during the Round 1 sampling event. During the Round 2 sampling event aldrin was not detected at concentrations exceeding the GWQS of 0.04 ug/L at any of the 67 wells sampled. Based on the analytical groundwater results, pesticide compounds are not of concern at the former Arsenal and no further action with regard to pesticides in groundwater is recommended.

- PCBs were not detected at any of the well locations sampled during either the Round 1 or 2 sampling events. Since PCBs were not detected in groundwater site-wide, no further action is recommended for these compounds in groundwater at the former Arsenal.

- Dioxin and furans were not detected during either the Round 1 or 2 groundwater sampling events. No further action for these compounds is recommended.

- Based on the results of the Phase 2 RI groundwater sampling explosive compounds are not considered to be contaminants of concern. With the exception of Area 4, explosive compounds were not detected in any groundwater samples collected during either the Round 1 or 2 sampling events. Additional investigation of explosive compounds in Area 4 is discussed in Section 7.3.1. As yet, Area 12 groundwater has not been sampled for explosive compounds. This area will have explosive compounds analyzed for groundwater. Based on the analytical groundwater results (except for Area 12), explosive compounds are not a concern and no additional explosives sampling is recommended at any former Arsenal wells.

- Thiodiglycol was not detected during either the Round 1 or 2 groundwater sampling events. No further action for this compound is recommended.

SECTION 8.0

REFERENCES

Anderson, Harry, 1968. *Special Report No. 27 Geology and Ground-Water Resources of the Rahway Area.* State of New Jersey Department of Conservation and Economic Development, Division of Water Policy and Supply, p. 40.

Appel, Charles A., 1962, *Special Report No. 17 Salt-Water Encroachment Into Aquifers of the Raritan Formation in the Sayville Area, Middlesex County, New Jersey.* State of New Jersey Department of Conservation and Economic Development, Division of Water Policy and Supply.

Ashley, Gail M. 1992. *Geology and Land Use (of the Raritan Basin). Environmental Geology of the Raritan River Basin.* Ninth Annual Meeting of the Geological Association of New Jersey Field Guide and Proceedings. pp. 1-11.

Ashley, Gail M., and Motta, Christopher J. 1992. *Estuarine Hydraulics and Sediment Load (of the Raritan Estuary). Environmental Geology of the Raritan River Basin;* Ninth Annual Meeting of the Geological Association of New Jersey Field Guide and Proceedings. pp. 62-64.

Ashley, Gail M., and Renwick, William H. 1983. *Channel Morphology and Processes at the Riverine - Estuarine Transition, the Raritan River, NJ.* Spec. Publs. Int. Ass. Sediment, 6, 207-218.

Banino, George M. Markewicz, Frank J., and Miller, Jr., Joseph W. 1970. *Geologic, Hydrologic, and Well Drilling Characteristics of the Rocks of Northern and Central New Jersey.* State of New Jersey Department of Conservation and Economic Development, Bureau of Geology and Topography.

Barnsdale, Henry C., 1943. *Special Report No. 8 The Ground-Water Supplies of Middlesex County, New Jersey.* State of New Jersey, State Water Policy Commission, p. 160.

Dames & Moore, 1992. *Preliminary Report, Phase 1 RI Investigation of Select Areas of Former Raritan Arsenal.* U.S. Army Corps of Engineers, Kansas City District.

Dames & Moore, 1992. *Near-Surface Soil Sampling Program, Thomas A. Edison County Park and Middlesex County Community College, former Arsenal.*

Dames & Moore, 1993. *Archive Search Report Former Raritan Arsenal, Edison, New Jersey.*

Dames & Moore, 1993. *Limited Health Risk Assessment Middlesex County College Athletic Field and Thomas A. Edison Park.*

Driscoll, F.G., 1986. *Groundwater and Wells*; Johnson Division, St. Paul, Minnesota, pp. 205-247.

Fetter, C. W., 1988. *Applied Hydrology*; Merrill Publishing Co. Columbus, Ohio, p. 105.

Freeze, R.A., and Cherry, J. A., 1979. *Groundwater.* Prentice-Hall, Inc., Englewood Cliffs, New Jersey, p. 29, 152-162.

Gregg, D.O. 1968. *An Analysis of Ground-Water Fluctuations Caused by Ocean Tides in Glynn County, Georgia.* Ground Water, vol. 4 no. 3, pp. 24-32.

Hasen, Asghar, Kasabach, Haig F., and Malone, John E. 1969. *Water Resources of the Sayville Area, Middlesex County, New Jersey.* State of New Jersey Department of Conservation and Economic Development, Bureau of Water Resources, Water Development Section, p. 32.

International Technologies Corporation. 1992. *Final Engineering Report, former Arsenal, Contamination Evaluation, Edison, New Jersey.*

Kruze, A.W. Gerhard, and Quick, T.J. 1994. *Tidal Water Level Fluctuations in Water Wells on San Salvador Island, Bahamas.* Bulletin of the Association of Engineering Geologist, vol. XXXI, no. 1, pp. 75-89.

Longwill, S.M., and Wood, C., 1965, *Groundwater resources of the Brunswick Formation in Montgomery and Berks Counties, Pennsylvania.* Pennsylvania Geological Survey, 4th Series, Water Resources Report W22, p. 59.

McGlaughlin II, Franklin B. 1988. *"Influences of Discharge, Seasonality, and Urbanization on the Concentration, Speciation, and Bioavailability of Trace Metals in the Raritan Basin, New Jersey."* M.S. Thesis, Rutgers, The State University of New Jersey. New Brunswick, New Jersey, p. 174.

Metcalf and Eddy, Inc., 1991, *Archives Search Report for Middlesex County College and Thomas A. Edison Park, former Arsenal, Edison, New Jersey. U.S. Army Corps of Engineers, Huntsville Division.*

Michalski, A., 1990. *Hydrology of the Brunswick (Passaic) Formation and Implications for Ground Water Monitoring Practice.* Ground Water Monitoring Review, vol. 10 no. 4, pp. 134-143.

OBG, 1989. *Final Engineering Report, Former Raritan Arsenal, Contamination Evaluation.* U.S. Army Corps of Engineers, Kansas City District.

Olsen, 1980. *Field Studies of New Jersey Geology and Guide to Field Trips.* Rutgers University, Newark, New Jersey.

Millham, N.P., and Howes B.L. 1995. *A Comparison of Methods to Determine K in a Shallow Coastal Aquifer.* Ground Water, vol. 33 no. 1, pp. 49-56.

Nichols, 1968. *Groundwater Resources of Essex County, New Jersey.* New Jersey Department of Conservation and Economic Development, Trenton, New Jersey.

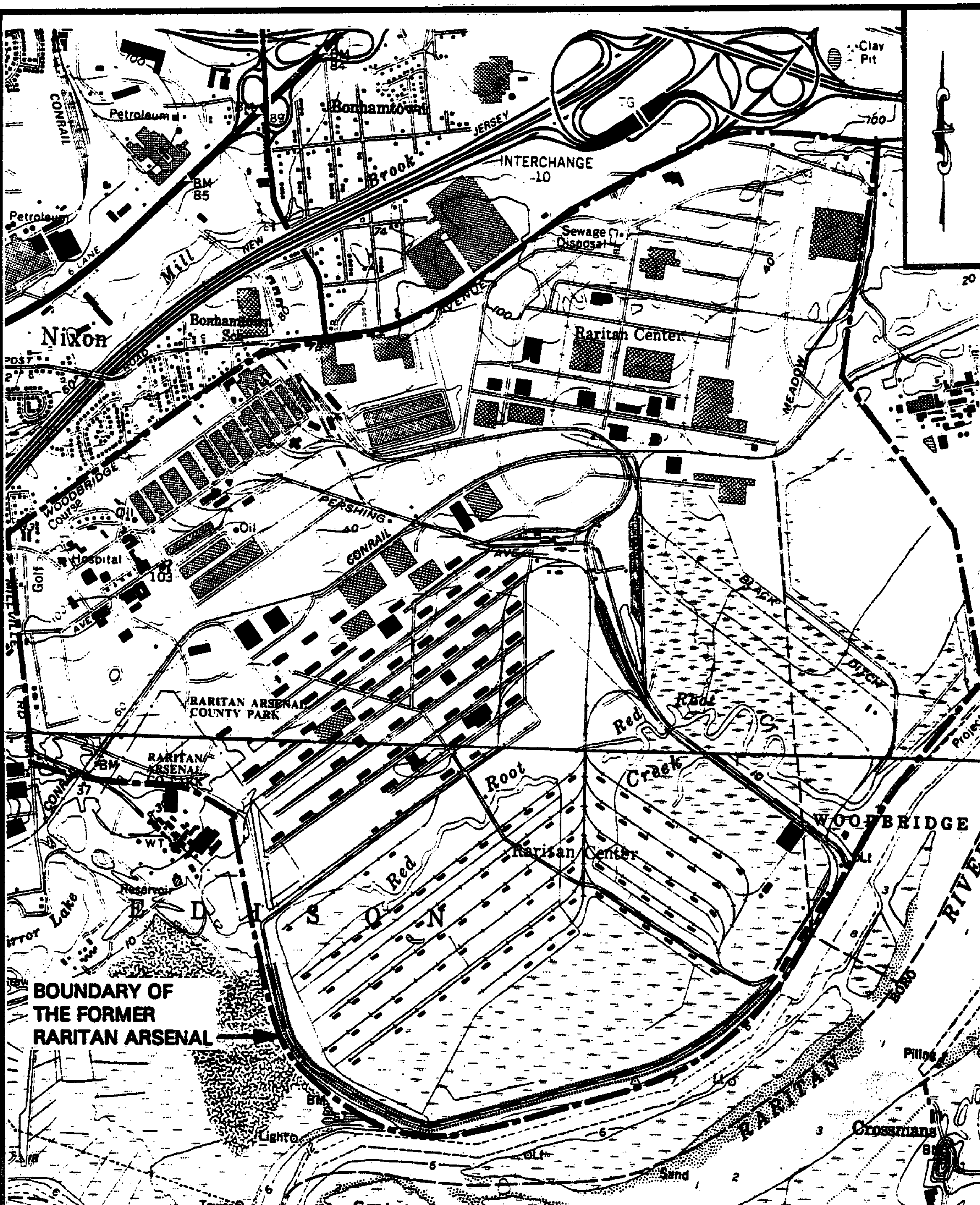
Powley, V.R. 1987. *Soil Survey of Middlesex County, New Jersey.* U.S. Department of Agriculture, Soil Conservation Services, p. 218.

Series, M. E. 1991. *Determining the Mean Hydraulic Gradient of Ground Water Affected by Tidal Fluctuations.* Ground Water, vol. 29 no. 4, pp. 549-555

WESTON, Inc., May 1995. *Phase 2 Remedial Investigation/Feasibility Study, Site-Wide Surface Water and Sediment Investigation Report.* Contract Number DACA41-92-D-8002.

Williams, J. and Conger, R., 1990. *Preliminary Delineation of Contaminated Water-Bearing Fractures Intersected by Open-Hole Bedrock Wells.* Ground Water Monitoring Review, vol. 10 no. 4, pp. 118-126.

Zapecza, O.S., 1984. *Hydrogeologic Framework of the New Jersey Coastal Plain.* U.S. Geological Survey. Open-File Report 84-730, p. 61.



SOURCE: U.S.G.S. 7.5' PERTH AMBOY/SOUTH AMBOY QUADS, P.R. 1981

SCALE: 1" = 2000'

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	SITE LOCATION MAP	
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: JUNE 1995	FIGURE #: 1-1

REVISION #: FILE NAME: TBLOCKS.DWG DATE: 5/31/95 DRAWN BY: B. MAC PLOT NAME:

LEGEND

MW-50	MONITORING WELL LOCATION
PW-23B	PROPOSED WELL LOCATION
	AREA BOUNDARIES
	WATERWAY
SG-2	STAFF GAUGE LOCATIONS

NOTES:

ALL EXISTING AND NEWLY INSTALLED WELLS WERE SURVEYED DURING THE PHASE II RI INVESTIGATION BY GEOD CORPORATION.

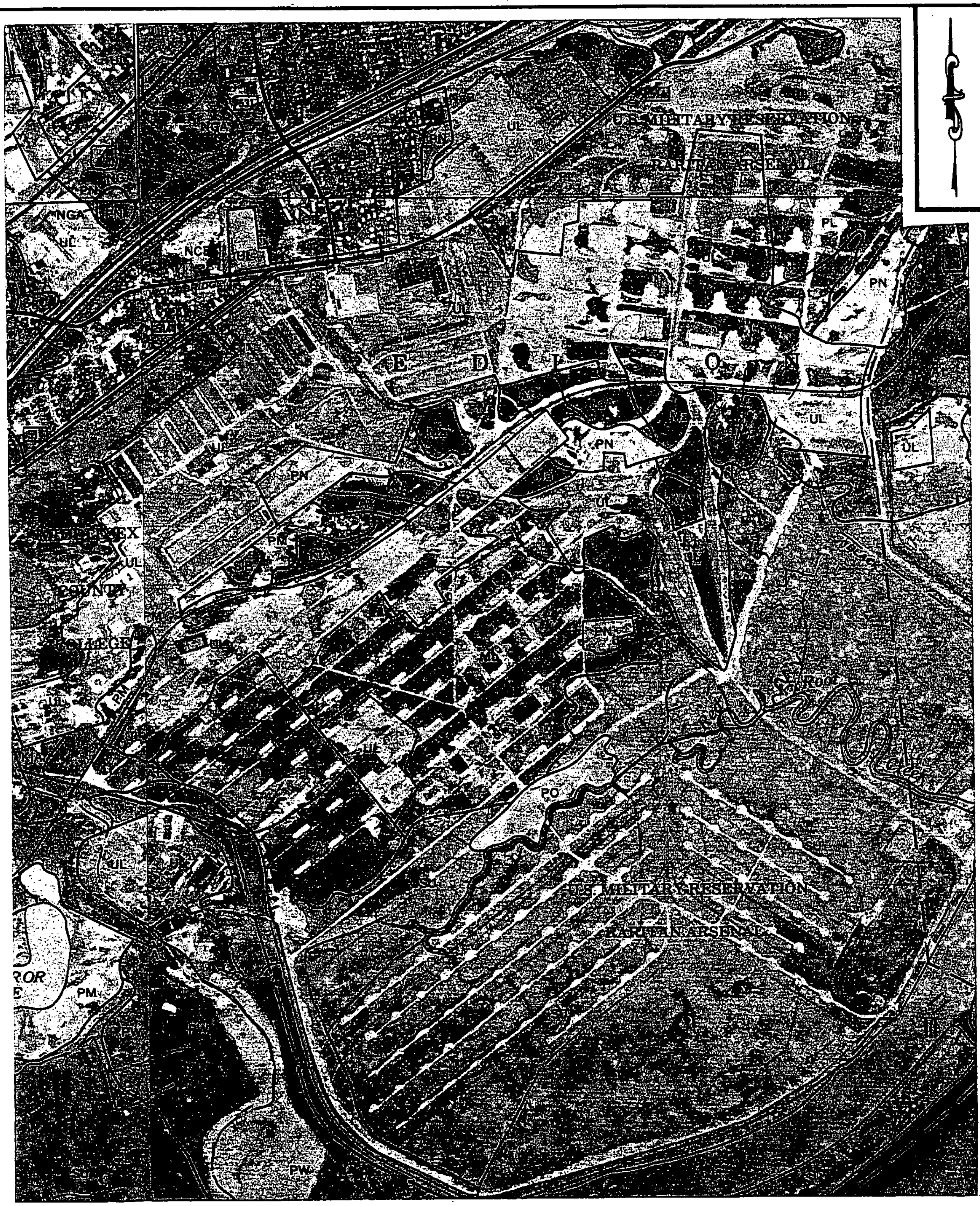
THIS SITE MAP HAS BEEN ADAPTED FROM A PHOTOGRAMMETRIC BASE MAP OF THE FORMER RARITAN ARSENAL PREPARED BY GEOD CORPORATION (12/22/92 OVERFLIGHT PHOTOGRAPHY) UNDER SUBCONTRACT TO WESTON.

GRAPHIC SCALE

500 0 250 500 1000 2000

(IN FEET)
1 inch = 500 ft

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION, EDISON, NEW JERSEY	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS		SITE MAP
		CONTRACT No. DACA41-92-D-8002	DELIVERY ORDER No. 0008	
		WORK ORDER No. 03886-082-010-0005	DATE: MAY 1996	REVISION No. / FIGURE #: 1-2



SOURCE: U.S.D.A., 1987, SOIL SURVEY OF MIDDLESEX COUNTY, NEW JERSEY

SCALE: 1:20,000

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	SOILS DELINEATION MAP	
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: 02/01/93	FIGURE #: 2-1

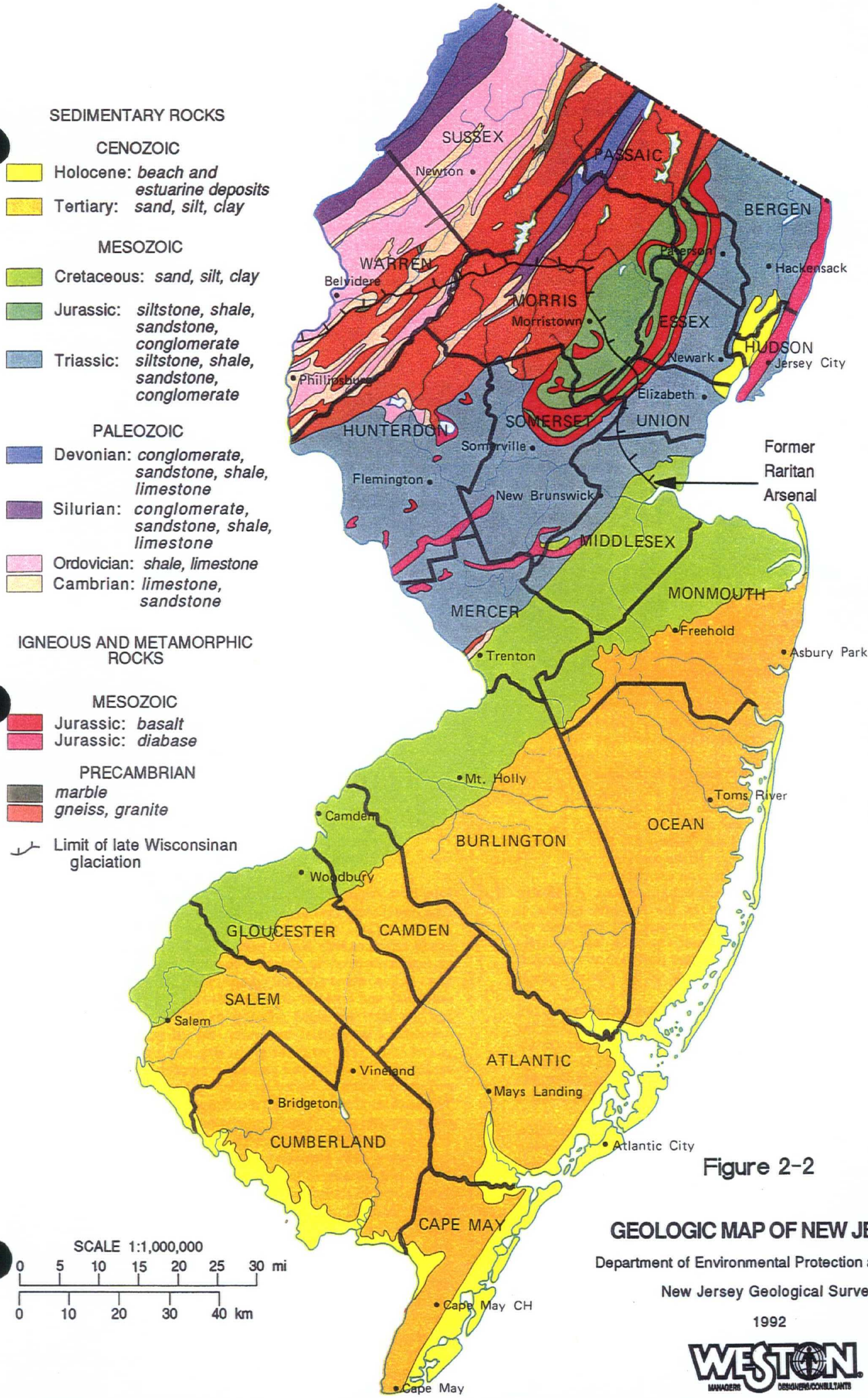


Figure 2-2

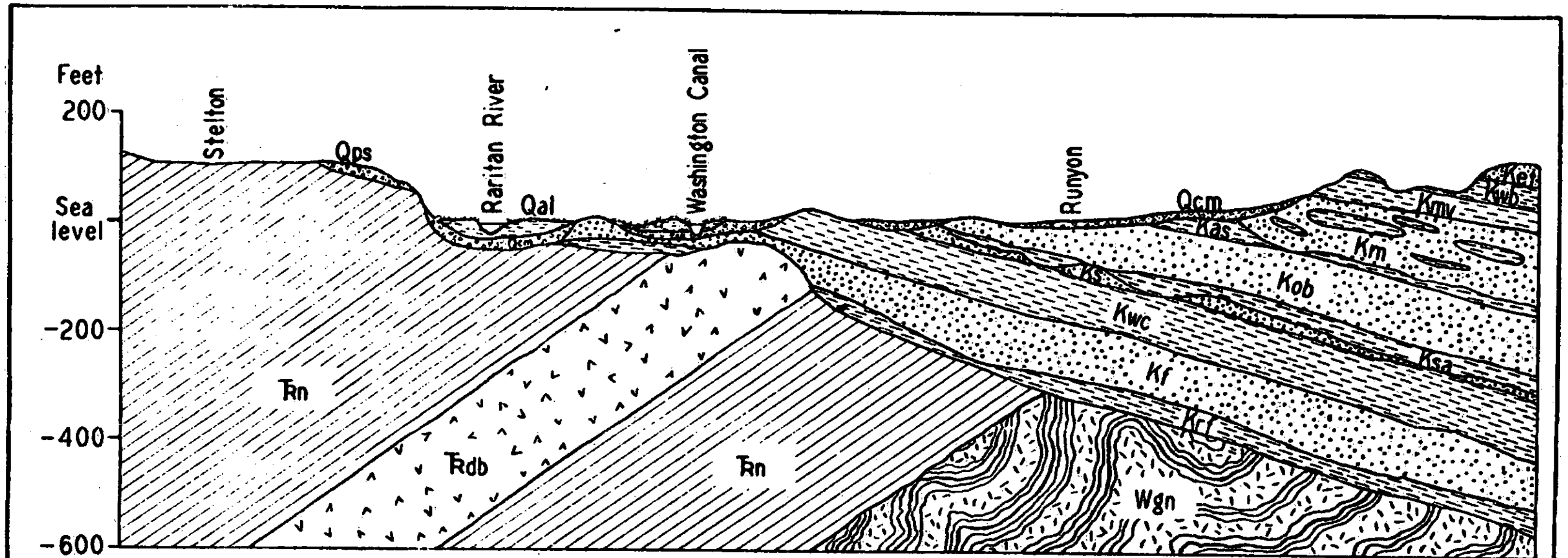
GEOLOGIC MAP OF NEW JERSEY

Department of Environmental Protection and Energy

New Jersey Geological Survey

1992

WESTON
MANAGERS DESIGNERS/CONSULTANTS



QUATERNARY

- Qal — Alluvium
- Qcm — Cape May fm.
- Qps — Pensauken fm.

0 1 2 3
Miles

CRETACEOUS

- SAND
- CLAY

Ket	Englishtown sand	Ksa	South Amboy fire clay
Kwb	Woodbury clay	Ks	Sayreville sand
Kmv	Merchantville clay	Kwc	Woodbridge clay
Km	Magothy fm.	Kf	Farrington sand
Kas	Amboy stoneware clay	Krf	Raritan fire clay
Kob	Old Bridge sand		

TRIASSIC

- Ŧdb — Diabase sill
- Ŧn — Newark group

PRE-CAMBRIAN ?

- Wgn — Wissahickon fm.

J.M.L.

REVISION #: 0000 DATE: 5/31/95
FILE NAME: TBLOCKS.DWG DRAWN BY: B. MAC

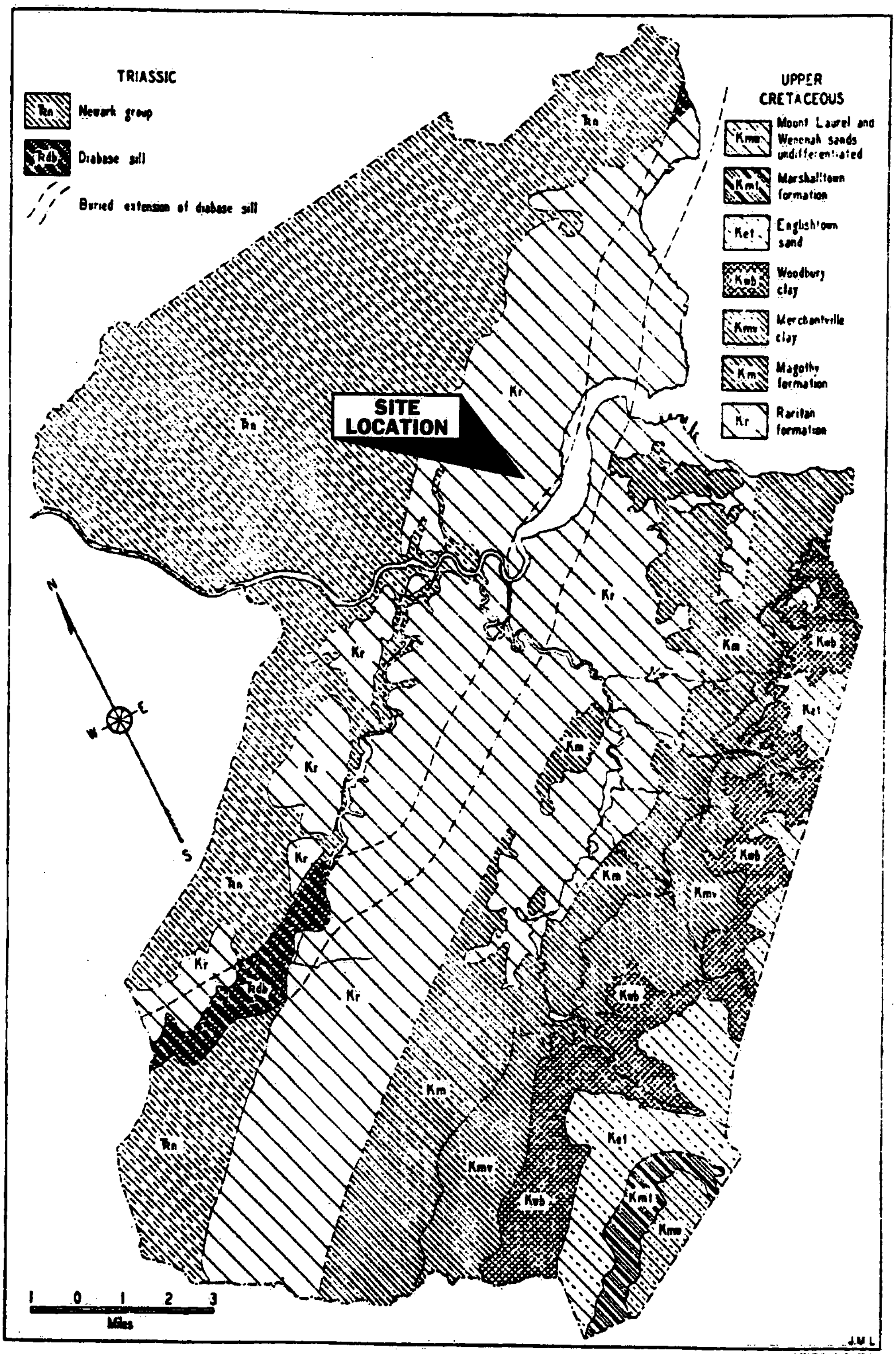
WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

GENERALIZED GEOLOGIC CROSS SECTION OF MIDDLESEX COUNTY

DATE: JUNE 1995

FIGURE #: 2-3



REVISION #: FILE NAME: TBLOCKS.DWG DATE: 5/31/95 DRAWN BY: PLOT NAME: B. MAC

WESTON
MANAGERS DESIGNERS/CONSULTANTS

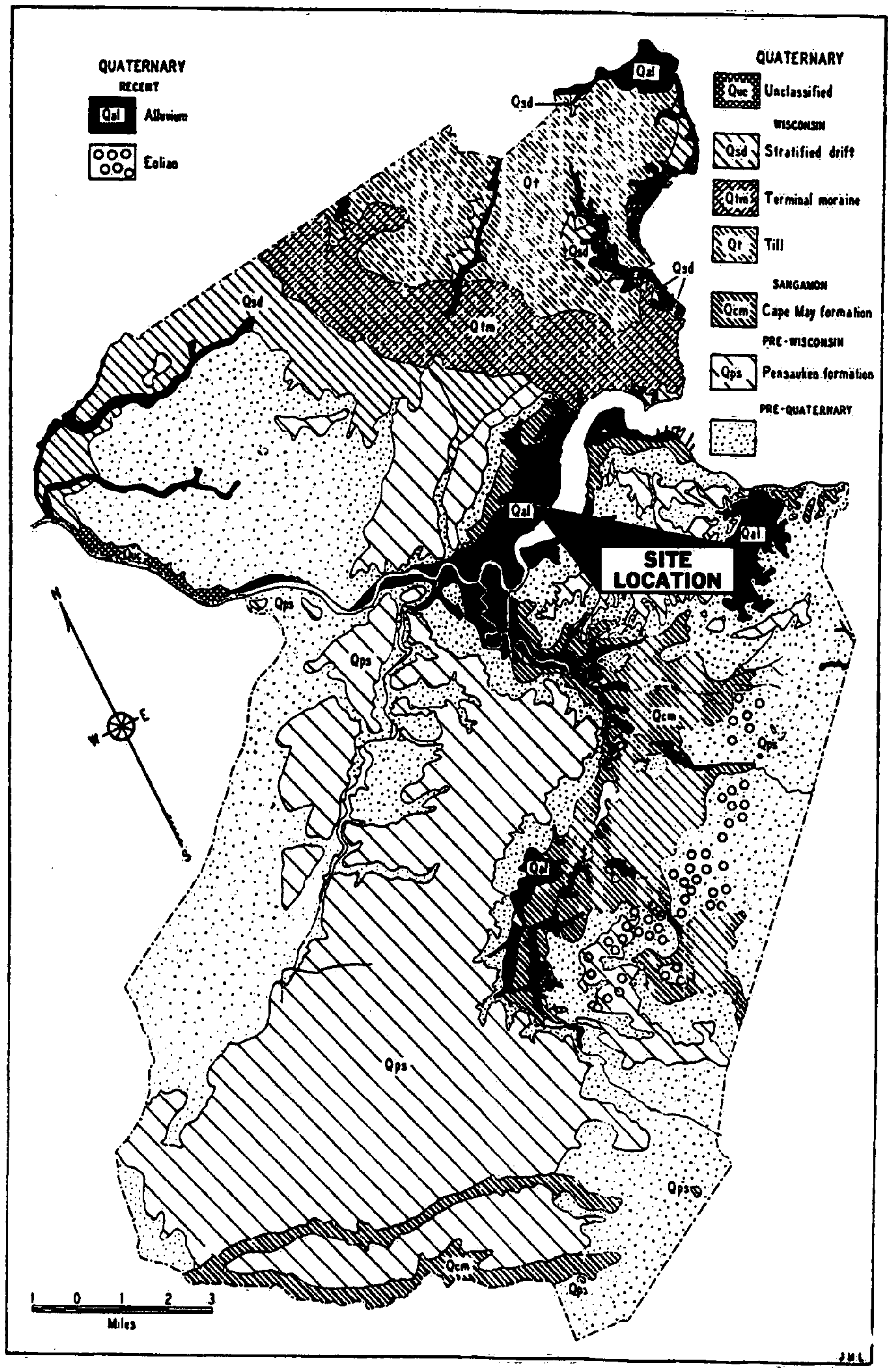
PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

GEOLOGIC MAP OF TRIASSIC BEDROCK AND CRETACEOUS OVERBURDEN EXPOSURES IN MIDDLESEX COUNTY

DATE: JUNE 1995

FIGURE #: 2-4



PROJECT NAME: FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

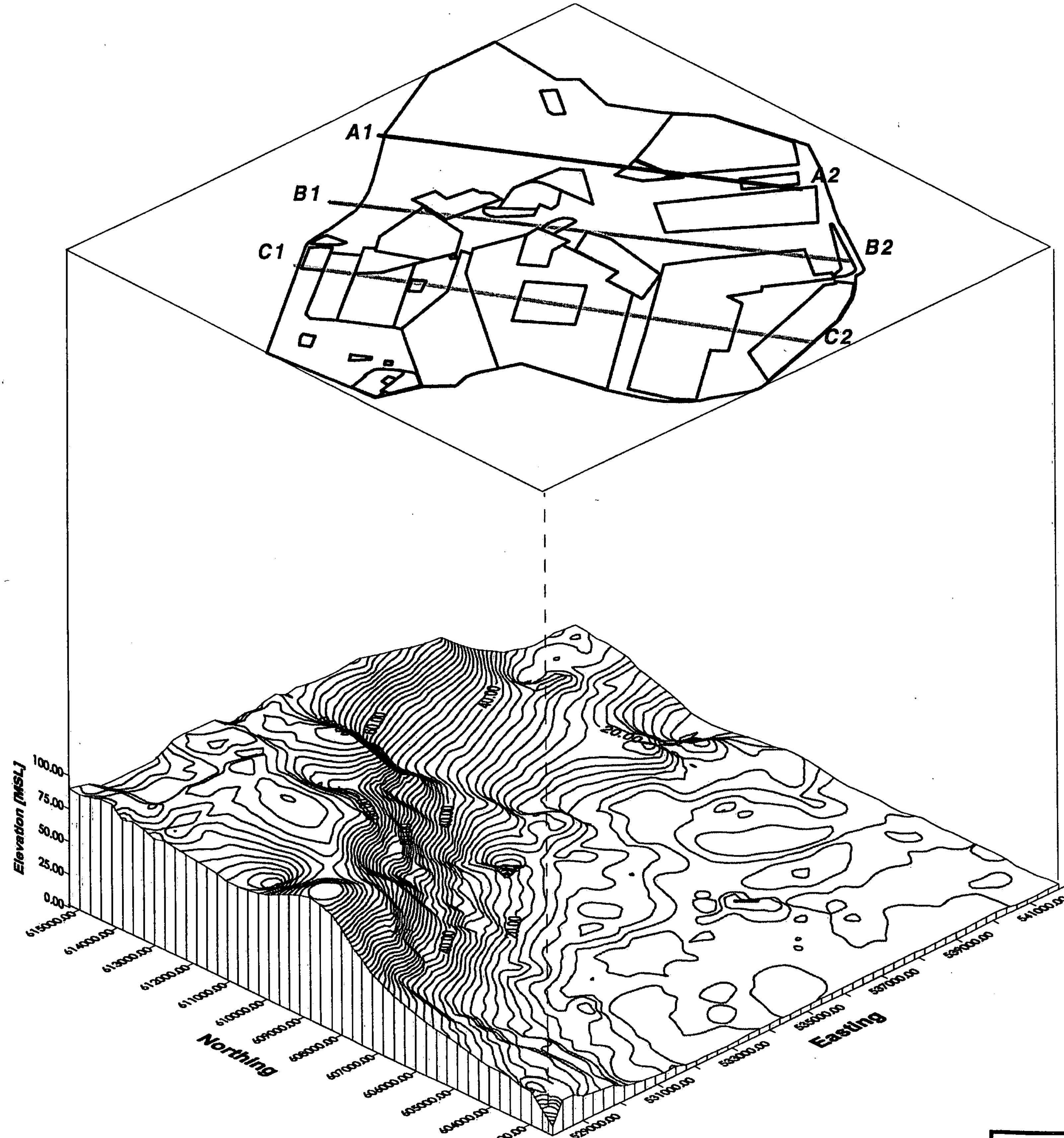
GEOLOGIC MAP OF QUATERNARY OVERBURDEN UNITS IN MIDDLESEX COUNTY

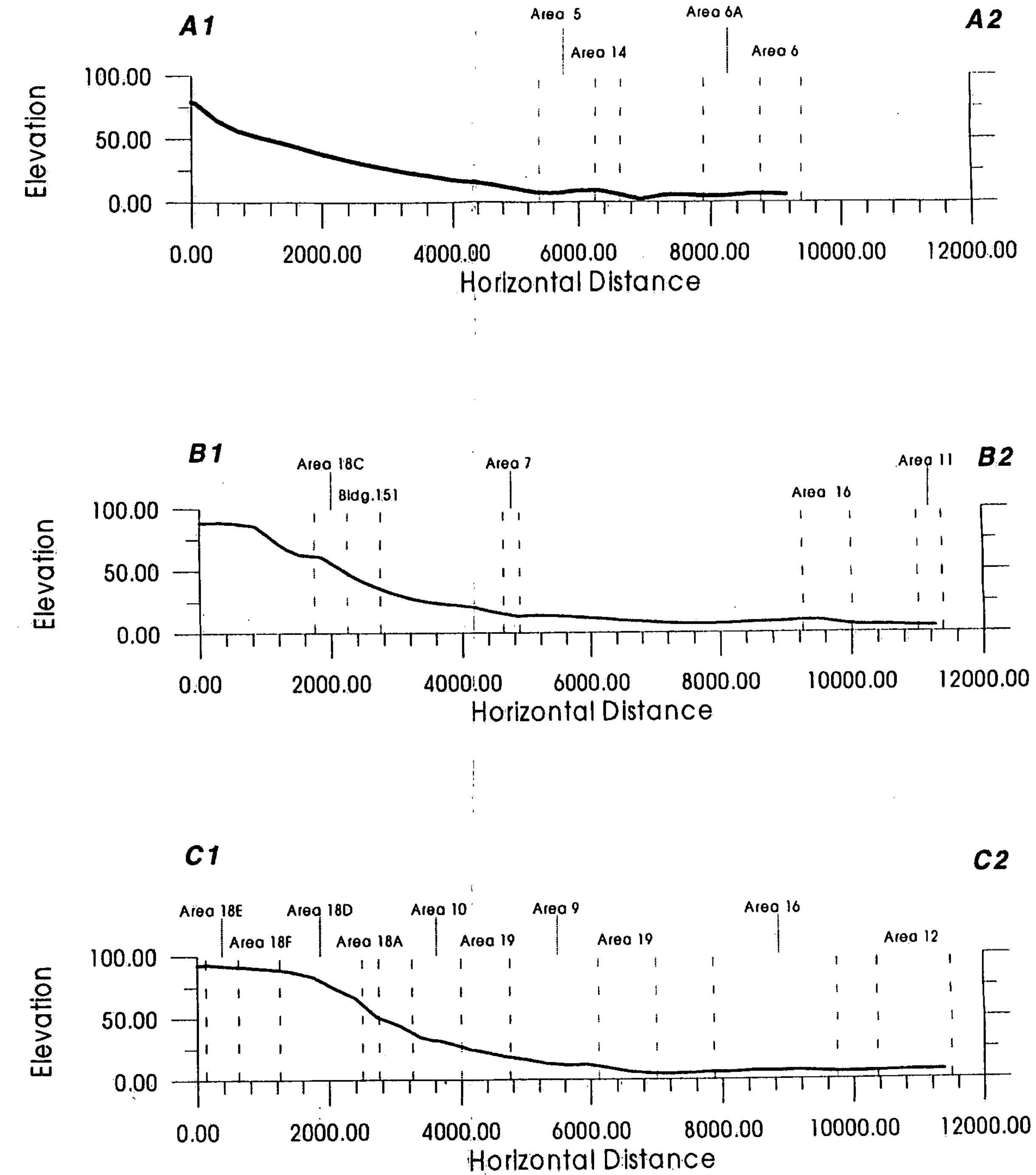
DATE: JUNE 1995

FIGURE #: 2-5

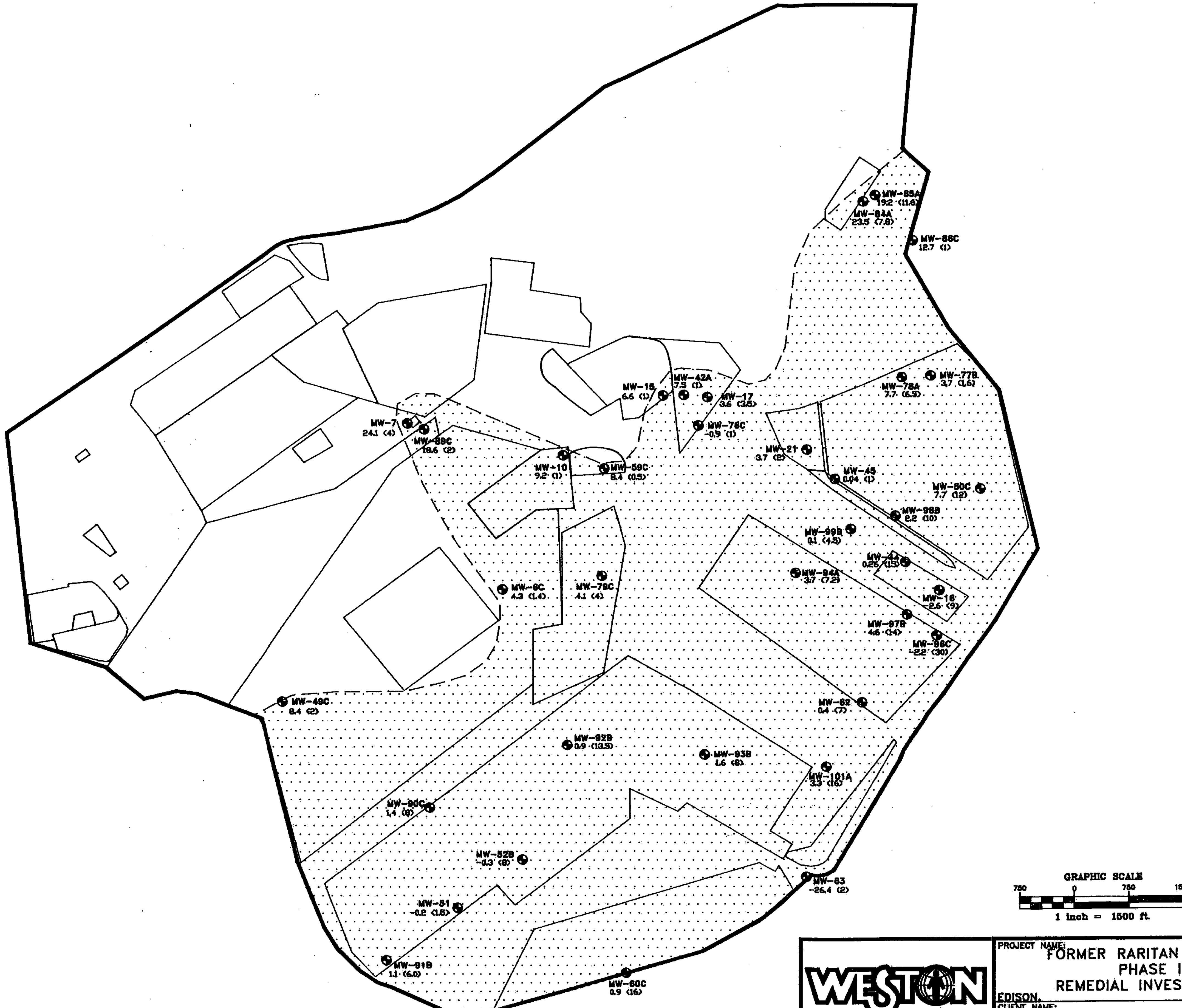
WESTON MANAGERS DESIGNERS/CONSULTANTS

REVISION #: FILE NAME: TBLOCKS.DWG DATE: 5/31/95 DRAWN BY: PLOT NAME: B. MAC





WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	TOPOGRAPHIC MAP
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: JUNE 1995 · FIGURE #: 4-1



<u>LEGEND</u>

MW-50C 7.7 (12) — MONITORING WELL LOCATIONS ELEVATION OF MEADOWMAT UNIT AND (THICKNESS) IN FEET

AREA BOUNDARIES

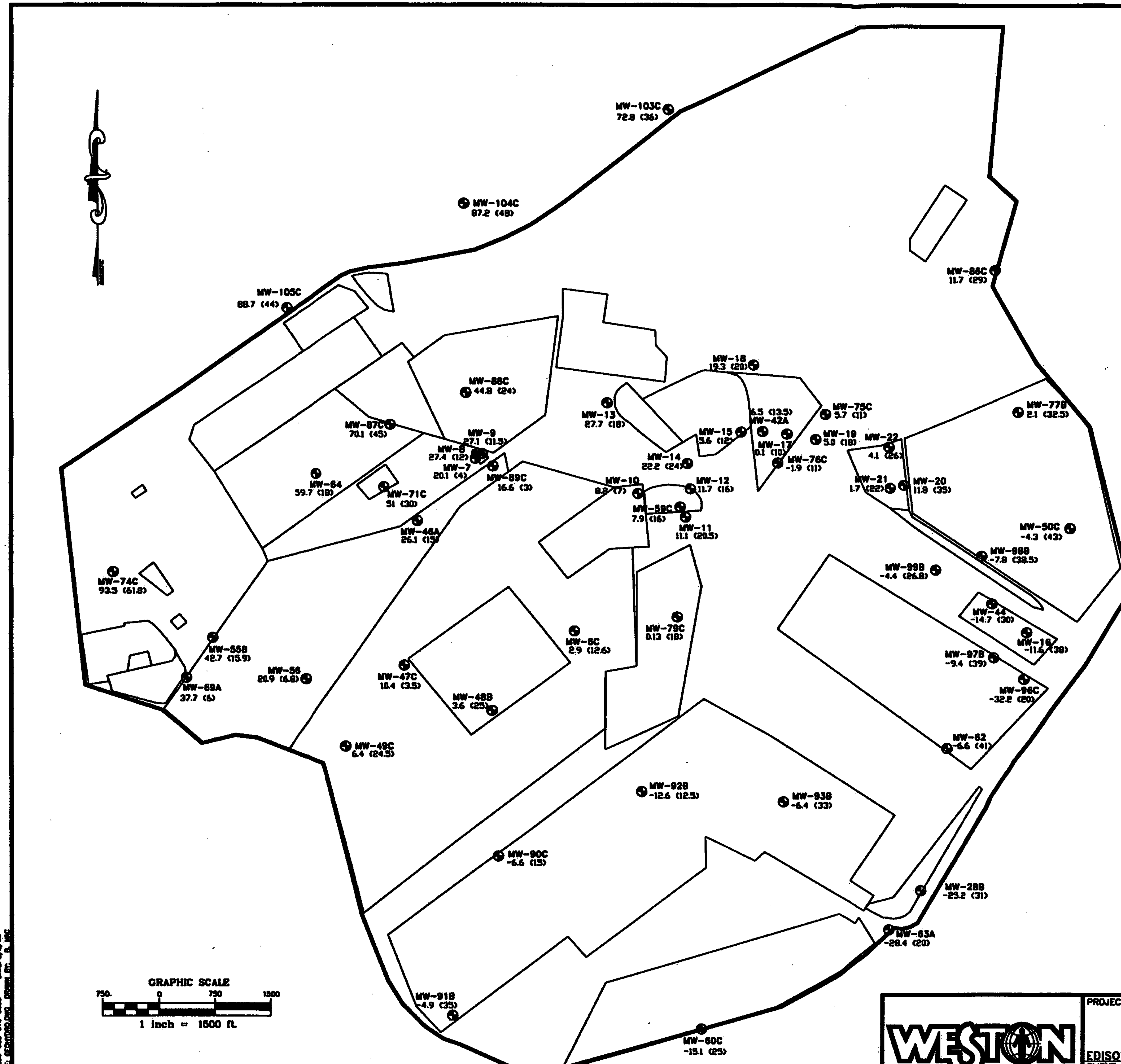
APPROXIMATE EXTENT OF MEADOWMAT UNIT. NOT ALL WELLS THAT ENCOUNTERED THE MEADOWMAT UNIT ARE SHOWN. MEADOWMAT UNIT WAS NOT ENCOUNTERED IN ANY WELLS TO THE NORTH OF THE SHADED REGION. ALL VALUES POSTED REPRESENT DATA FOR THE DEEPEST WELL WITHIN A CLUSTER, OR A VALUE REPRESENTATIVE FOR THAT PORTION OF THE SITE.

NOTE: ELEVATION DATA (FEET MSL) ARE REPORTED IN NGVD OF 1929.

FOR A COMPLETE UNDERSTANDING AND INTERPRETATION OF THIS FIGURE, REFER TO THE TEXT IN SECTION 4.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	DISTRIBUTION AND THICKNESS OF MEADOWMAT	
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: 6/2/95	FIGURE #: 4-2



LEGEND

MW-50C -4.3 (43) — MONITORING WELL LOCATIONS ELEVATION OF LOWER SAND UNIT AND (THICKNESS) IN FEET

AREA BOUNDARIES

NOTES: THE DATA DEPICTED IS FOR MONITORING WELLS THAT FULLY PENETRATED THE LOWER SAND. THE LOWER SAND IS PRESENT THROUGHOUT THE ENTIRE FORMER ARSENAL. NOT ALL WELLS THAT ENCOUNTERED THE LOWER SAND UNIT ARE SHOWN. ALL VALUES POSTED REPRESENT DATA FOR THE DEEPEST WELL WITHIN A CLUSTER OR A VALUE REPRESENTATIVE FOR THAT PORTION OF THE SITE.

ELEVATION DATA (FEET MSL) ARE REPORTED IN NGVD OF 1929.

FOR A COMPLETE UNDERSTANDING AND INTERPRETATION OF THIS FIGURE, REFER TO THE TEXT IN SECTION 4.

RESULTS POSTED FOR MW-42A ARE TAKEN FROM THE LOG FOR SOIL BORING 42B DRILLED BY DAMES & MOORE.

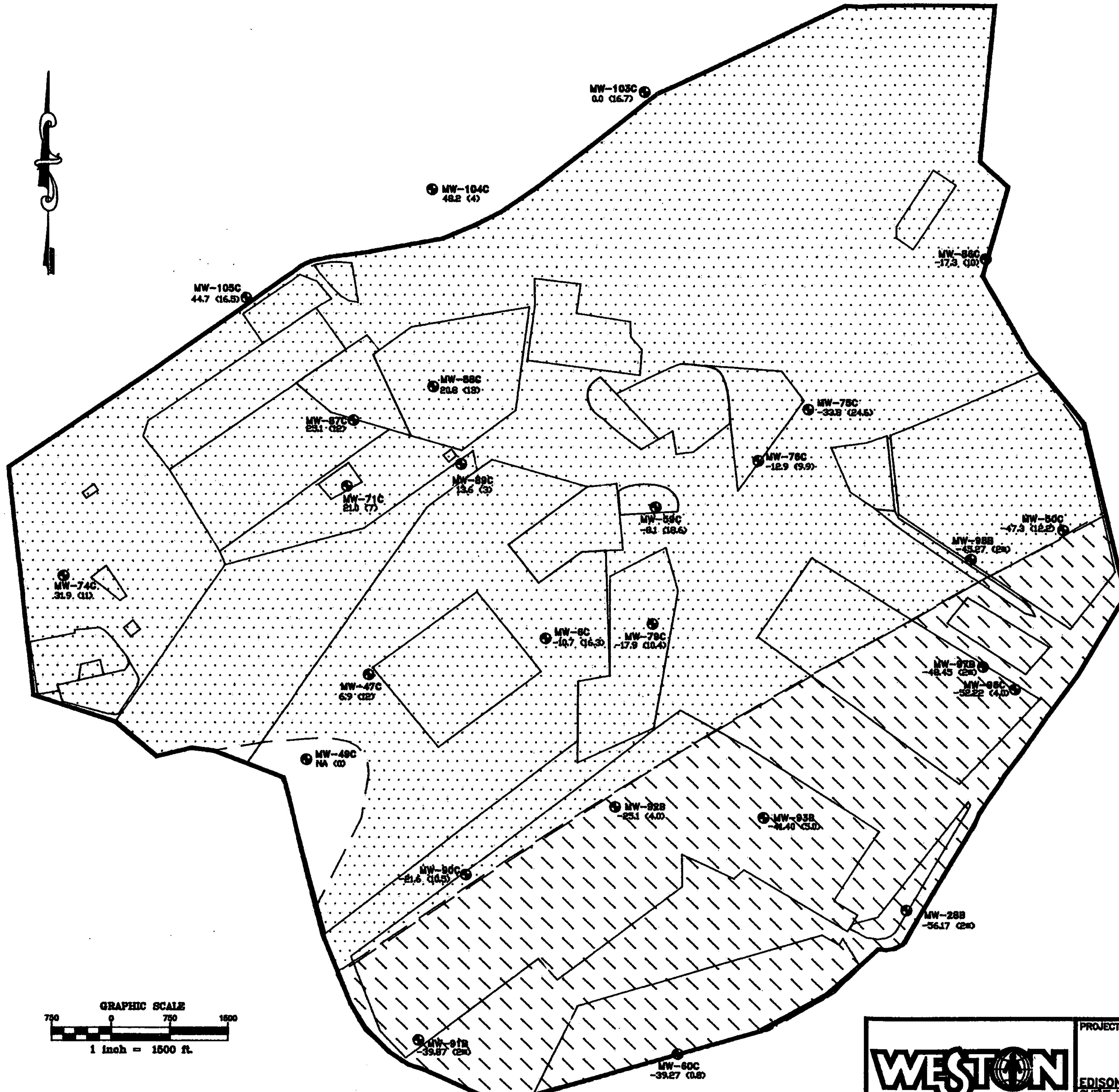
WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

DISTRIBUTION AND THICKNESS OF LOWER SAND

DATE: MAY 1996

FIGURE #: 4-3



LEGEND

MW-80C -47.3 (12.2) — MONITORING WELL LOCATION ELEVATION OF RARITAN FIRE CLAY OR SAPROLITE UNIT AND (THICKNESS) IN FEET

AREA BOUNDARIES

APPROXIMATE EXTENT OF THE RARITAN FIRE CLAY UNIT. ONLY MONITORING WELLS THAT FULLY PENETRATED THE RARITAN FIRE CLAY UNIT ARE SHOWN. THE RARITAN FIRE CLAY UNIT WAS NOT ENCOUNTERED IN THE UNSHADED REGIONS.

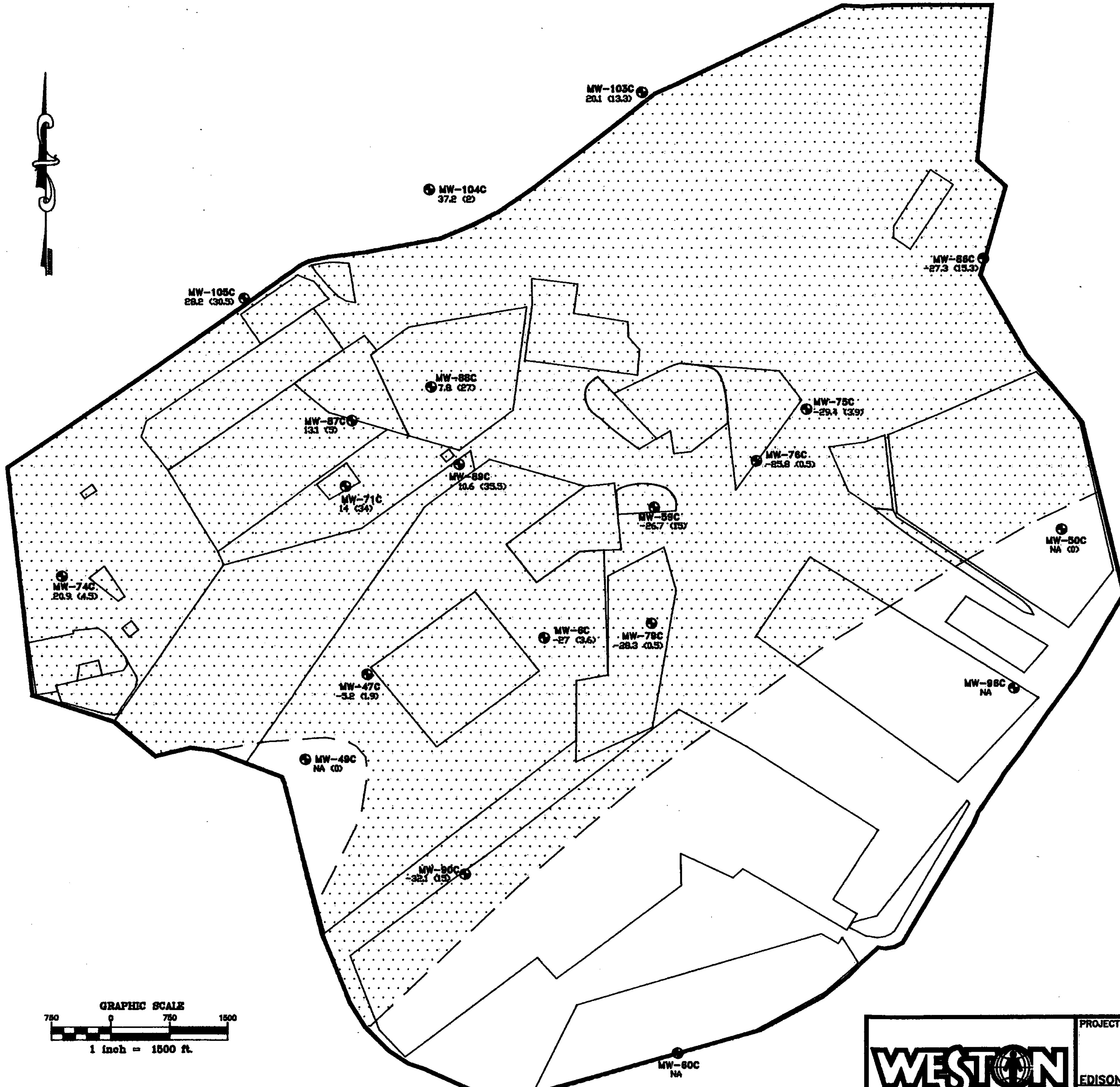
APPROXIMATE EXTENT OF SAPROLITE UNIT. ONLY MONITORING WELLS WHICH OBSERVED THE SAPROLITE UNIT ARE SHOWN.

NOTE: ELEVATION DATA (FEET MSL) ARE REPORTED IN NGVD OF 1929.

FOR A COMPLETE UNDERSTANDING AND INTERPRETATION OF THIS FIGURE, REFER TO THE TEXT IN SECTION 4.

* - TOTAL THICKNESS OF SAPROLITE DEPOSIT HAS NOT BEEN DETERMINED

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	DISTRIBUTION AND THICKNESS OF RARITAN FIRE CLAY AND SAPROLITE UNITS	
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: MAY 1996	FIGURE #: 4-4



LEGEND

MW-50C NA (0)	MONITORING WELL LOCATIONS ELEVATION OF WEATHERED PASSAIC UNIT AND (THICKNESS) IN FEET
	AREA BOUNDARIES
	APPROXIMATE EXTENT OF THE WEATHERED PASSAIC UNIT. ONLY MONITORING WELLS THAT FULLY PENETRATED THE WEATHERED PASSAIC UNIT ARE SHOWN. THE WEATHERED PASSAIC UNIT WAS NOT ENCOUNTERED IN THE UNSHADED REGIONS.

NOTES: ELEVATION DATA (FEET MSL) ARE REPORTED IN NGVD OF 1929.

FOR A COMPLETE UNDERSTANDING AND INTERPRETATION OF THIS FIGURE, REFER TO THE TEXT IN SECTION 4.

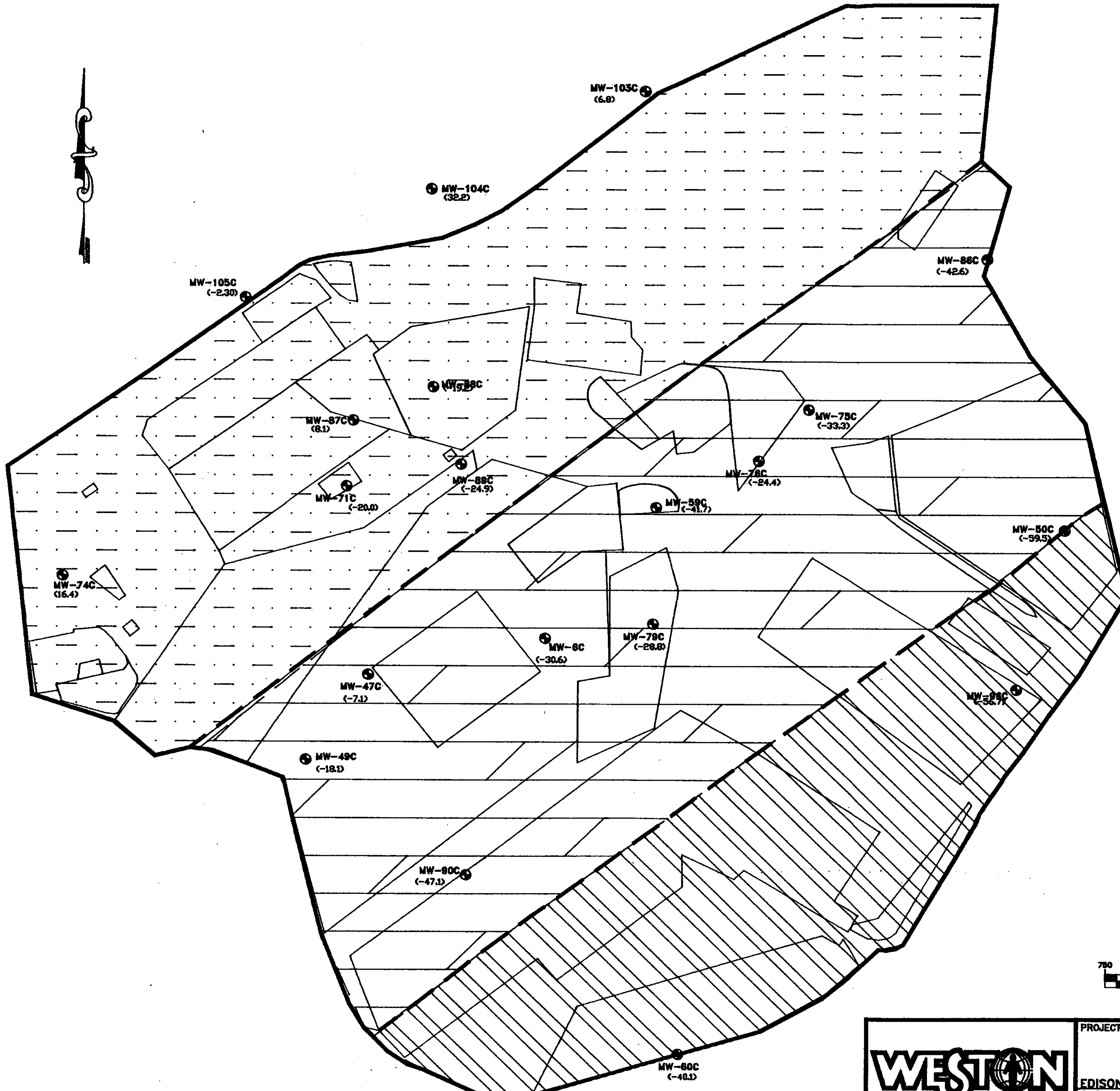
MW-96C & MW-60C WERE COMPLETED IN THE PALISADES SILL FORMATION.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

DISTRIBUTION AND THICKNESS OF WEATHERED PASSAIC UNIT

DATE: JUNE 1995
FIGURE #: 4-5



Well ID Location	Area	Recov./ Strength	Depth of Core (Feet from surface)	Rock Type	Rock Characteristics (Poro, Frac., Fill)
MW-6C	19	2 *	37.90 thru 72.25	Slate	2nd Prep, Gypsum Fill With Horz./Vert. Fractures
MW-47C	19	1 *	21.90 thru 42.40	Slate-Interbed SS(Lenticular BDG.)	Vuggy Porosity, Pyrite Fill Vert. Fractures
MW-49C	19	3 *	39.20 thru 48.25	Slate-Horz./ Vert. Fractures	Calcite/Gypsum Fill Vert. Fractures
MW-50C	14	4 *	70.20 thru 104.30	Slate/Diabase	Gypsum Fill, Granitic Vein Mod. Angle Fractures
MW-59C	7	3 O	54.00 thru 78.85	Slate-(SS/SLTST)	Calcite Fill, Vugs High Angle Fractures
MW-60C	12	4 *	47.00 thru 82.00	Diabase	Low Angle Fractures
MW-71C	18A	2 *	71.00 thru 107.60	Shale-Fractured	High Angle Fractures Vugs, Laminations
MW-74C	17	3 *	85.00 thru 105.00	Shale-W/Siltstone	Fill, Horz. Fractures
MW-75C	4	3 *	45.50 thru 65.00	Slate Meta-Siltstone	Fractured, Pyrite Fill, Open Fractures
MW-76C	4	2-3 *	36.50 thru 58.00	Slate-Interbedded, Meta-(SS/SLTST)	Vugs, Vert./Horz. Fractures
MW-79C	8	1-3 *	38.40 thru 63.00	Slate	Calcite/Gypsum Fill Fractures
MW-86C	15	2 *	58.30 thru 93.30	Slate Meta-Siltstone	Gypsum Fill High Angle Fractures
MW-87C	18D	2-3 *	64.00 thru 84.00	Shale-W/Some Siltstone & Soft Seams	Vugs, High Angle Fractures
MW-88C	18C	50 *	78.00 thru 99.00	Shale-W/Siltstone Interbeds	WBK Interbeds of SS/Siltstone, Dip 5-15 deg.
MW-89C	10	2 O	28.50 thru 68.10	Siltstone-Soft Horz./Vert. Fractures	Weathered Zones, Horz./High Angle Fractures
MW-90C	16	3 *	41.00 thru 88.00	Slate-Weathered Zone 41-62ft Some Meta-SS/SLTST	Low to Moderate Angle Fractures
MW-96C	6	4 *	62.50 thru 82.70	Diabase-W/Pyrite	Few Fractures Some Open/Part, Pyrite Fill
MW-103C	B	2 *	74.08 thru 94.00	Shale-Breccia Zone, Low and High Angle Fractures	Fractured Gypsum Fill
MW-104C	B	2 *	57.00 thru 90.90	Shale Weathered Bed Plain	Banded, Fractures W/High Angle
MW-105C	B	2 *	95.00 thru 125.50	Shale, High Angle Fractures	Weak, Fractures Gypsum Fill

Notes:
SS = Sandstone
SLTST = Siltstone
Meta = Metamorphosed

Recovery
good = O
excellent = *

Strength
1 = soft
2 = weak
3 = moderate
4 = good

LEGEND

MW-50C (-59.5) BEDROCK MONITORING WELL LOCATION AND BEDROCK ELEVATION (IN FT. MSL NGVD OF 1929)

PASSAIC FORMATION

METAMORPHOSED PASSAIC FORMATION

PALISADES SILL

AREA BOUNDARIES

APPROXIMATE GEOLOGIC FORMATION CONTACT

GRAPHIC SCALE
750 0 750 1500
1 inch = 1500 ft.

NOTE: MW-103, 104, AND 105 WELL CLUSTER LOCATIONS ARE WITHIN THE PASSAIC FORMATION. THIS REGION IS NOT SHADED BECAUSE IT IS OFF SITE.

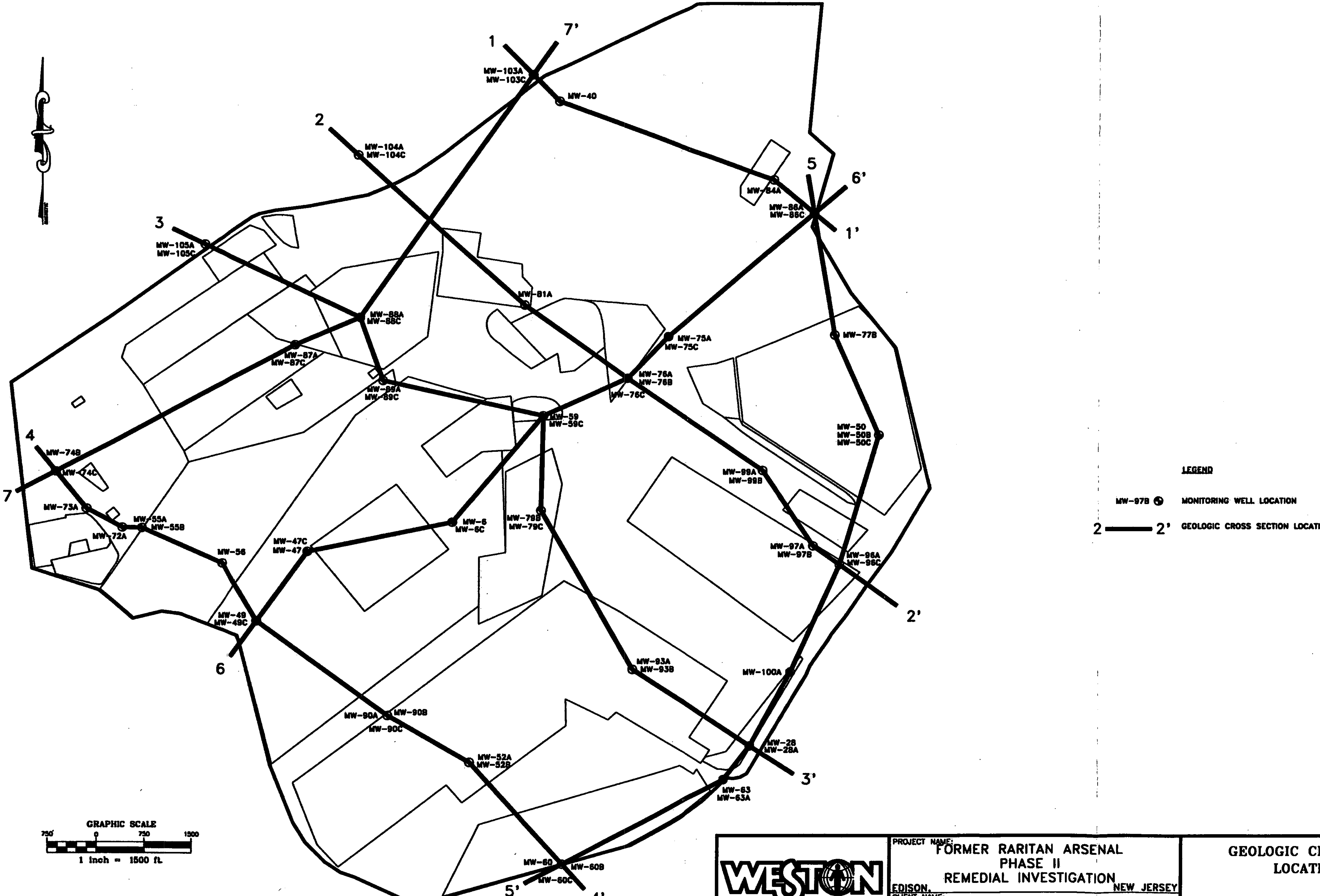
WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

DISTRIBUTION OF BEDROCK FORMATIONS

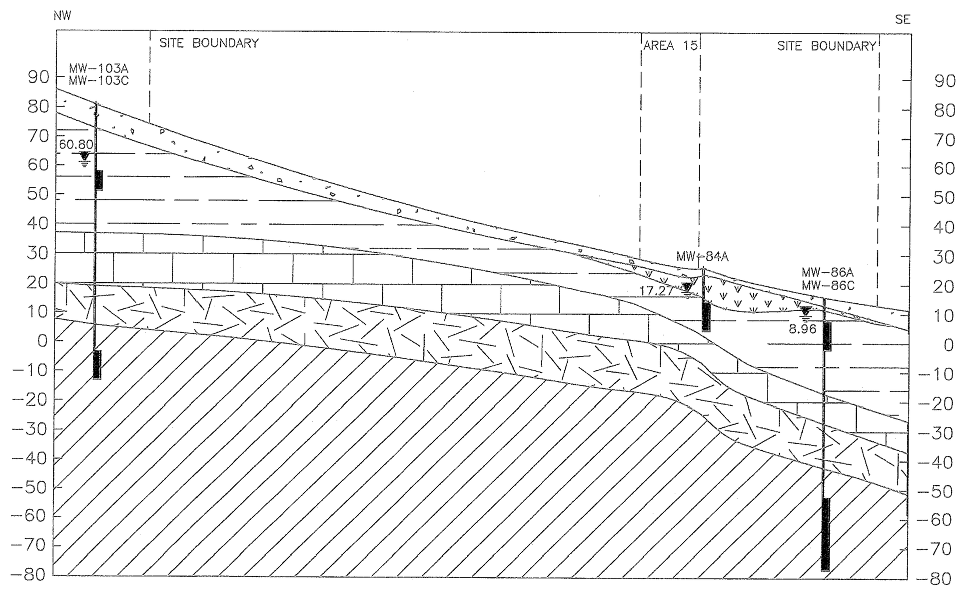
DATE: JUNE 1995

FIGURE #: 4-6

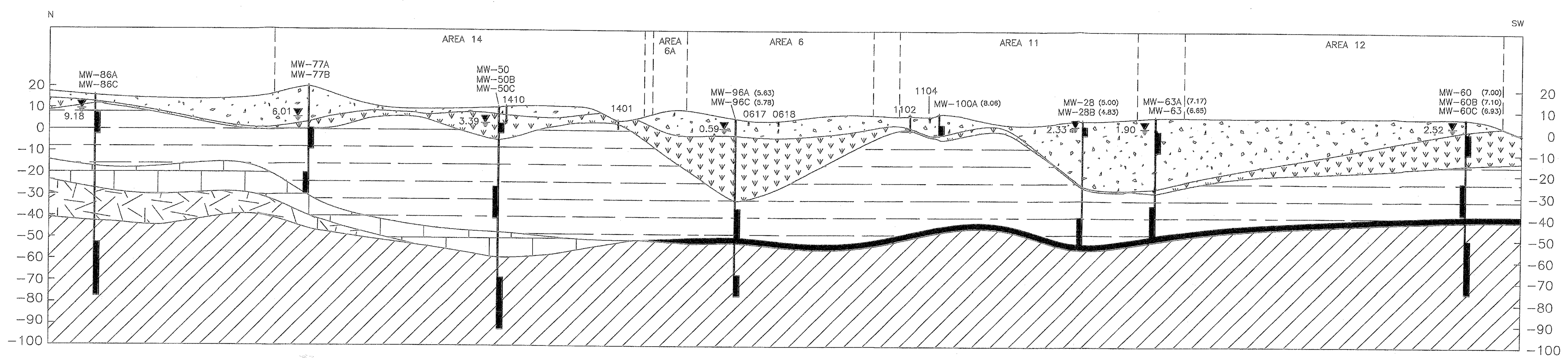


WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	GEOLOGIC CROSS-SECTION LOCATION MAP	
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: MAY 1996	FIGURE #: 4-7

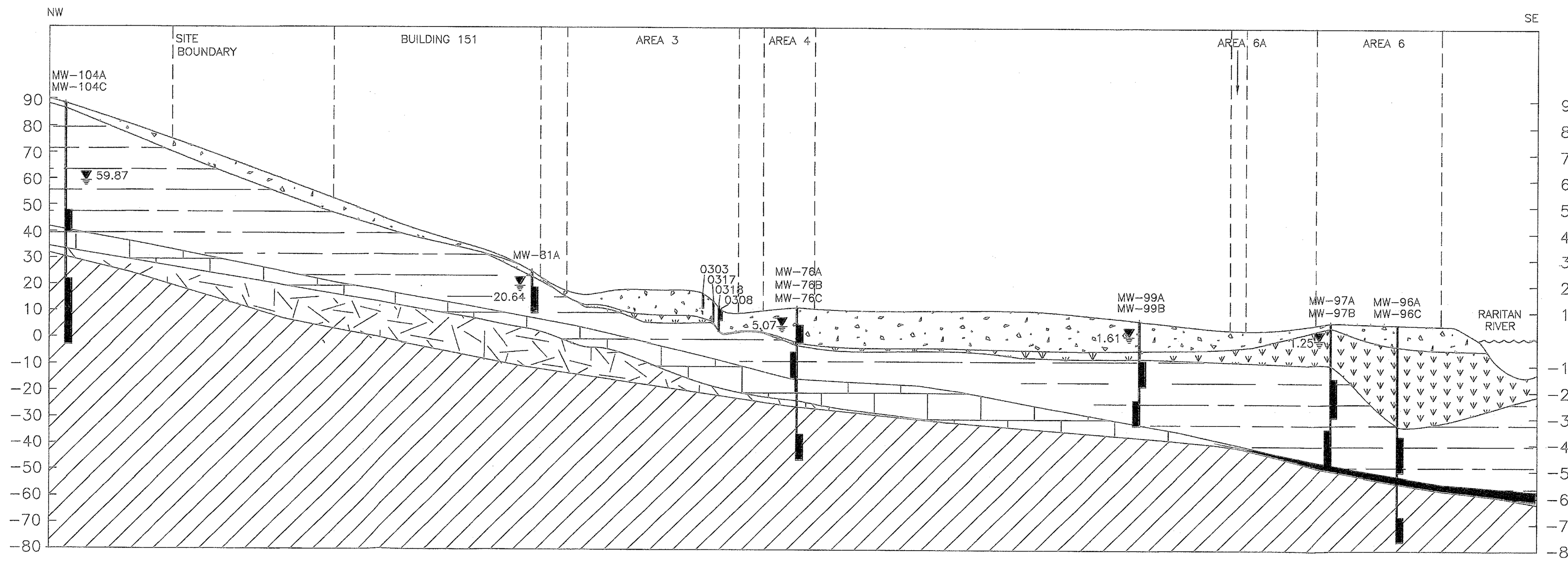
Section 1 -- 1'



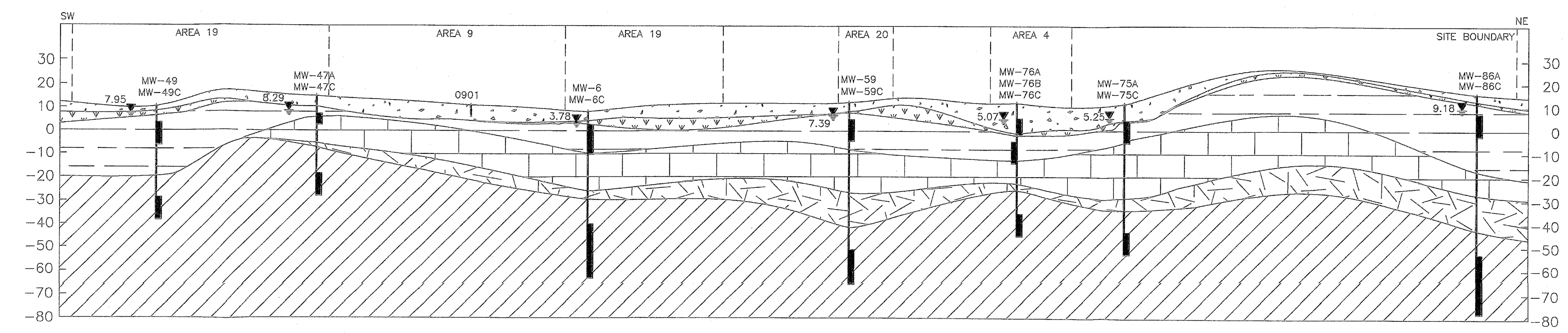
Section 5 -- 5'



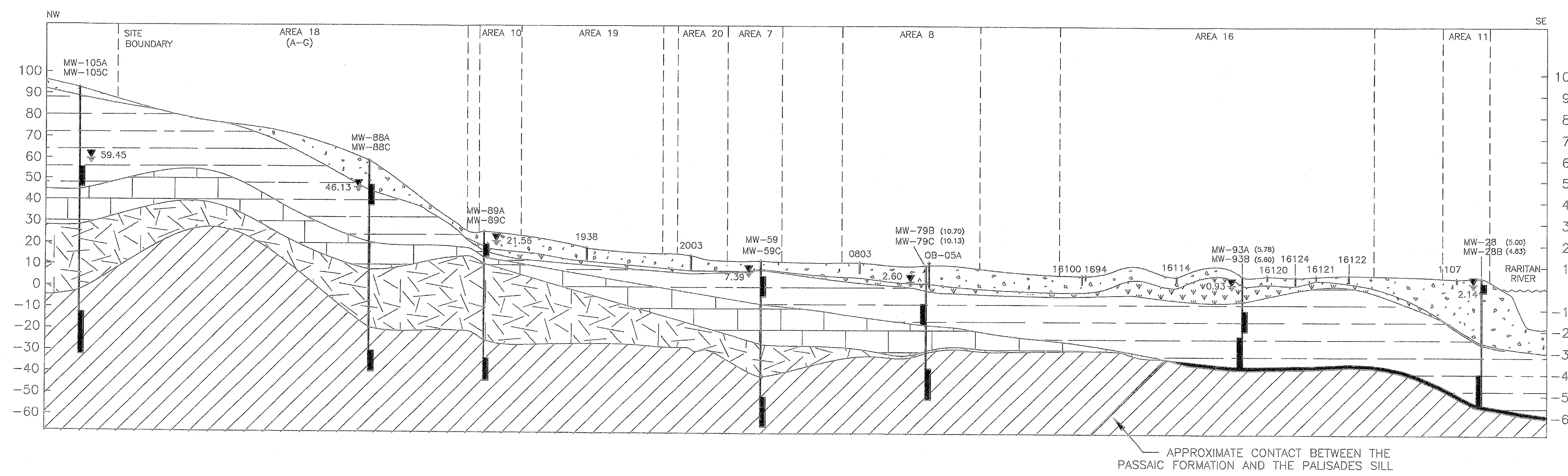
Section 2 -- 2'



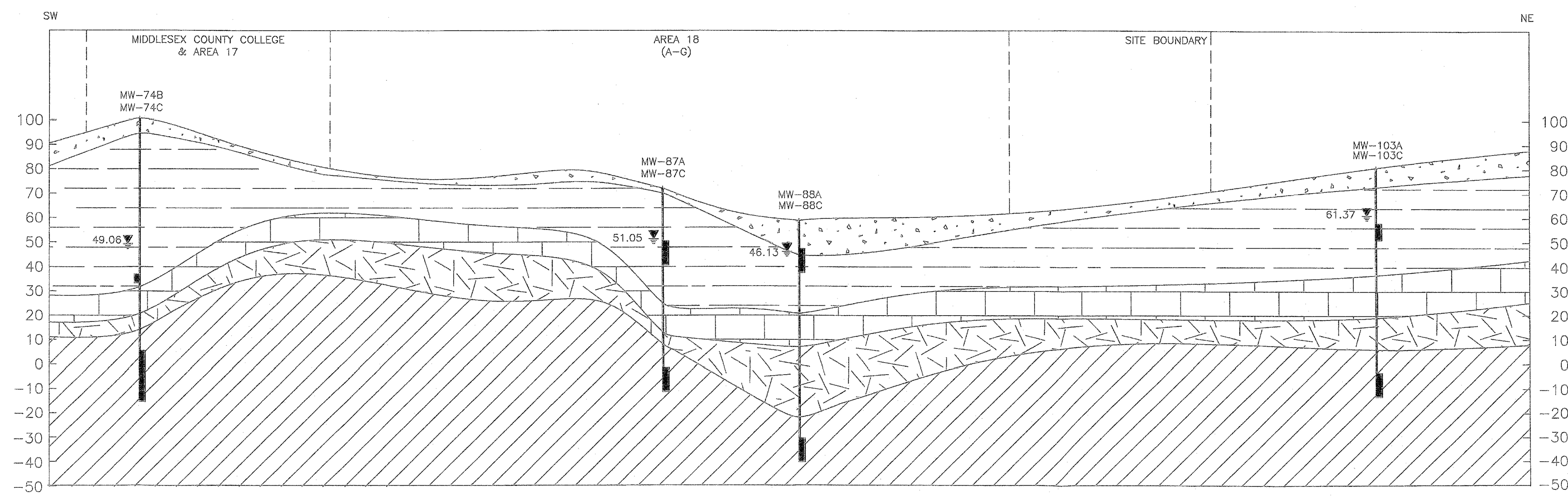
Section 6 -- 6'



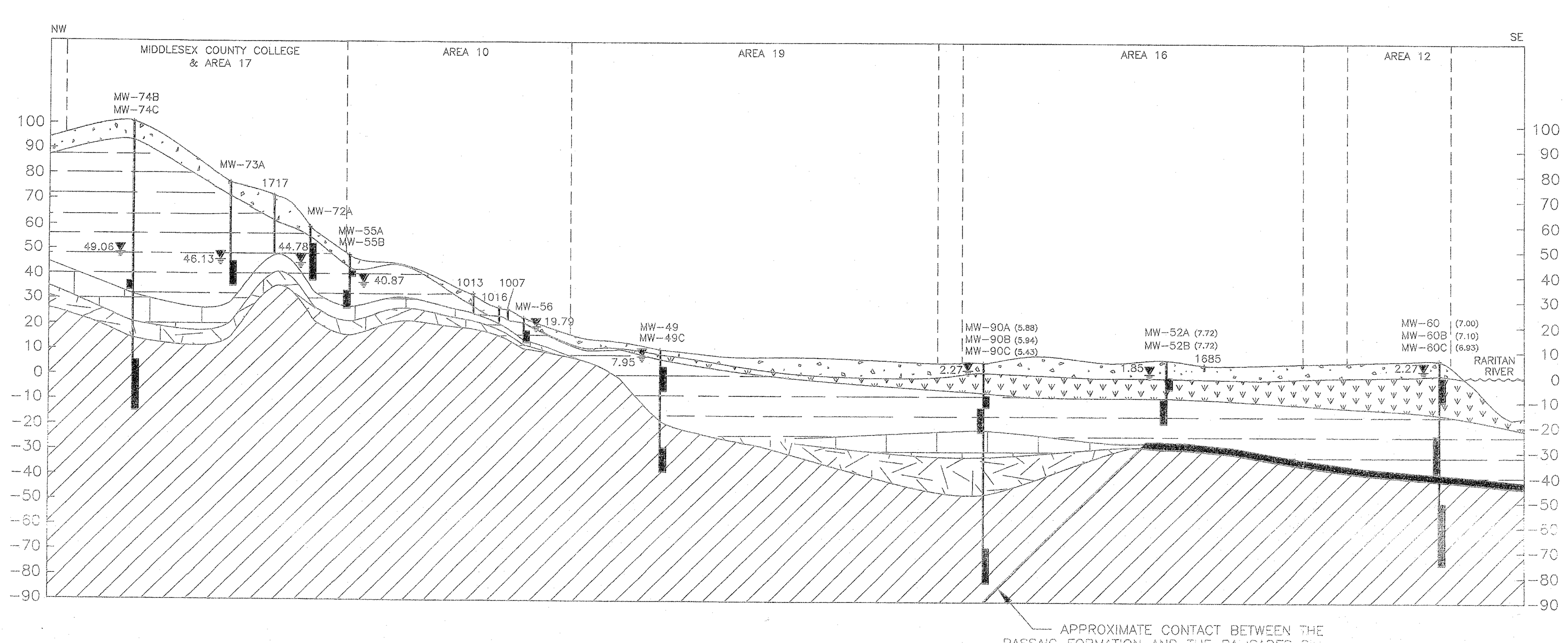
Section 3 -- 3'



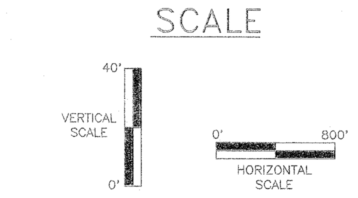
Section 7 -- 7'



Section 4 -- 4'



SCALE



VERTICAL EXAGGERATION: 20X

LEGEND

- UPPER SAND
- MEADOWMAT
- LOWER SAND
- RARITAN FIRE CLAY
- WEATHERED BEDROCK GROUP: WEATHERED PASSAIC UNIT; SAPROLITE OF THE PALISADES SILL
- BEDROCK
- APPROXIMATE AREA OR SITE BOUNDARY
- 51.01 GROUNDWATER LEVEL OF LOWER SAND (IN FT., MSL)
- OVERBURDEN OR OPEN HOLE BEDROCK MONITORING WELL
- MW-87A MONITORING WELL LOCATION
- 1104 SOIL BORING LOCATION

NOTES:

1) THE GEOLOGIC CROSS-SECTION AND RELATED INFORMATION SHOWN ON THIS FIGURE DEPICT SUBSURFACE CONDITIONS AT SPECIFIC TEST (SOIL) BORING OR MONITORING WELL LOCATION AT THE TIME OF DRILLING. GEOLOGIC CORRELATIONS SHOWN BETWEEN TEST BORINGS OR WELL LOGS ARE BASED ON THE PROCESSING OF A GEOLOGIC MODEL OF THE FORMER ARSENAL, WHICH WAS PERFORMED BY DYNAMIC GRAPHICS, INC. USING EARTHVISION, A COMMERCIAL SURFACE AND PROPERTY MODELING SOFTWARE PACKAGE. THE DATA USED TO CREATE THE GEOLOGIC MODEL INCLUDED ALL OF THE PHASE II RI TEST BORINGS AND WELL LOCATIONS AND DATA FROM SOME SELECT OBG AND DAMES & MOORE MONITORING WELL LOCATIONS. DATA REPRESENTING THE BASE OF VARIOUS GEOLOGIC ZONES WAS INTERPRETED FROM SOIL BORINGS AND WELL LOGS BY WESTON GEOLOGISTS. BATHOMETRIC DATA WITH RIVER BED DEPTHS IS BASED ON HISTORICAL REFERENCES. TOPOGRAPHIC ELEVATION DATA (REPORTED IN NGVD 1929) WAS USED TO CONTOUR THE SURFACE ELEVATIONS. THE DATA WAS INPUT INTO A MINIMUM TENSION SURFACE MODELING TECHNIQUE (GRIDDER) IN EARTHVISION TO DEVELOP SURFACE ESTIMATES AT REGULAR GRID LOCATIONS, AND THESE MODELS (GRIDS), WERE THEN COMBINED INTO CROSS-SECTIONS. ALL BORINGS OR WELLS WITHIN 50 FEET OF THE TRAVERSE LINES WERE USED TO CREATE INDIVIDUAL CROSS-SECTIONS AND ARE POSTED ON THE CROSS-SECTION. ACTUAL CONDITIONS BETWEEN BORINGS AND WELLS ARE UNKNOWN AND MAY DIFFER FROM THOSE SHOWN.

2) GROUNDWATER ELEVATION DATA IS ONLY SHOWN FOR ALL LOWER SAND WELLS, BASED ON THE 19 MARCH 1995 MEASUREMENT EVENT. IF NO GROUNDWATER ELEVATION IS NOTED, THEN THE MEASUREMENT WAS NOT AVAILABLE.

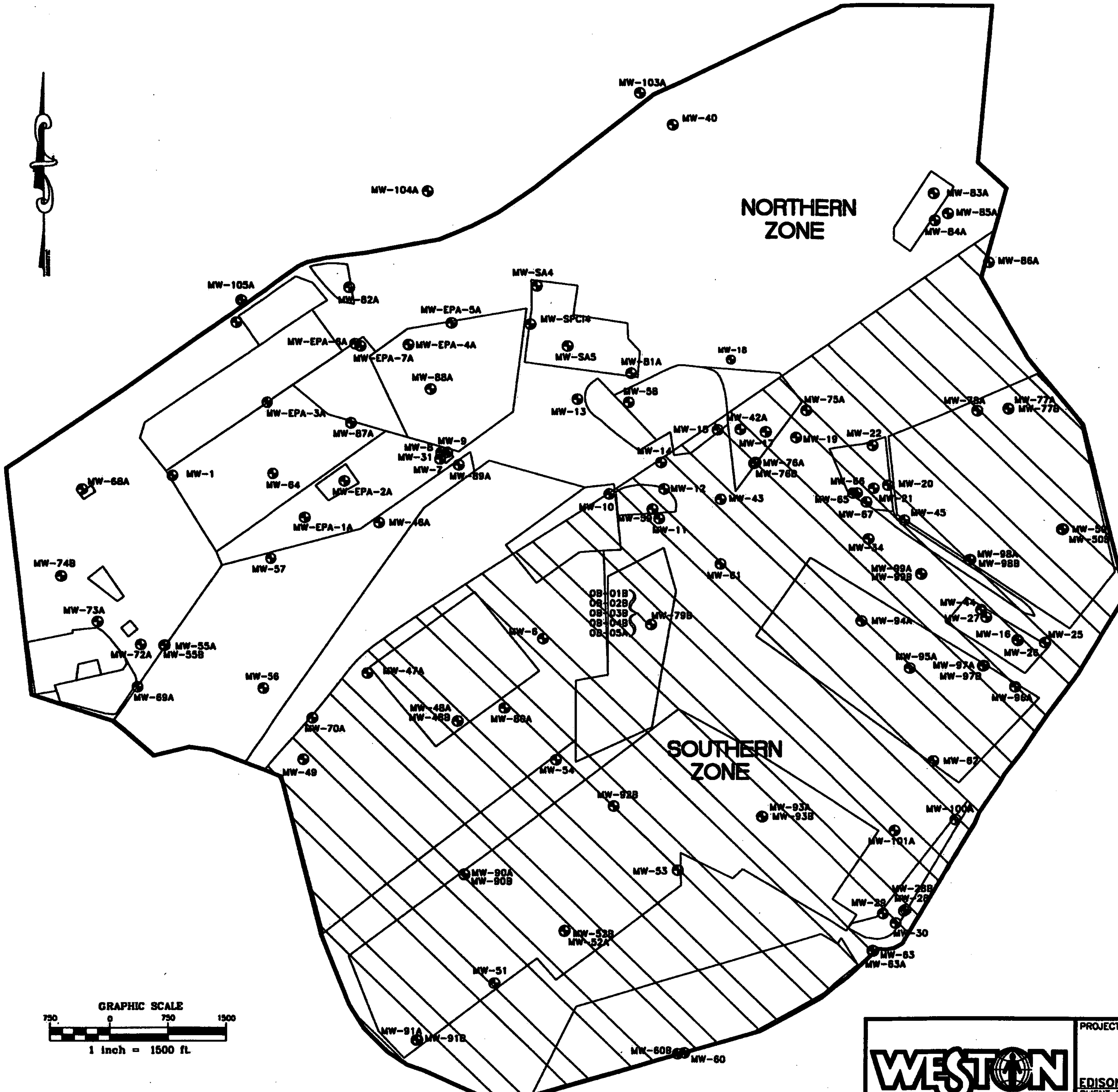
3) THE CROSS-SECTION GEOLOGY IS BASED ON THE LITHOLOGY FROM THE DEEPEST WELL IN THE CLUSTER. SUBTLE DIFFERENCES IN LITHOLOGY MAY EXIST BETWEEN WELLS IN CLUSTER.

4) FOR A COMPLETE AND PROPER UNDERSTANDING OF THIS FIGURE, REFER TO THE TEXT IN SECTION 4.0.

5) AREA BOUNDARIES SHOWN ON THESE GEOLOGIC CROSS-SECTIONS ARE ESTIMATED BASED ON FIGURE 4-7, GEOLOGIC CROSS-SECTION LOCATION MAP.

6) VERTICAL EXAGGERATION IS 20%

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	GEOLOGIC CROSS-SECTIONS (1-1' THROUGH 7-7')
		CONTRACT No. DACA41-92-D-8002 / DELIVERY ORDER No. 0008	
		WORK ORDER No. 03886-082-010-0005 / DATE: MAY 1996	REVISION No. 1 / FIGURE #: 4-8



LEGEND

MW-93A OVERBURDEN MONITORING WELLS

AREA BOUNDARIES

THE SOUTHERN HYDROLOGIC ZONE REPRESENTS GROUNDWATER ELEVATION DATA LESS THAN 10 FEET MSL NGVD OF 1929

WESTON
MANAGERS DESIGNERS/CONSULTANTS

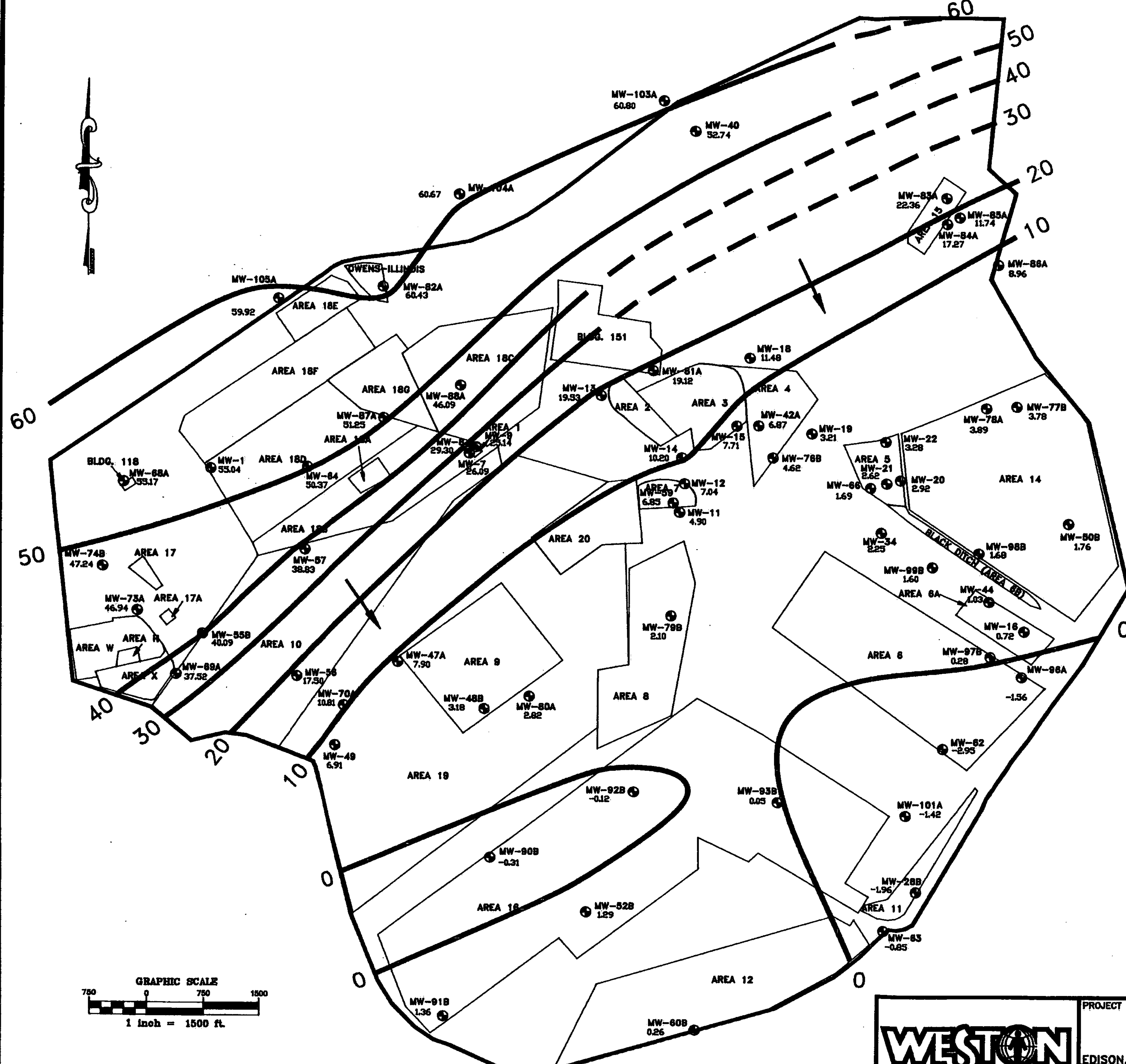
PROJECT NAME: FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

OVERBURDEN HYDROLOGIC ZONE MAP

DATE: MAY 1996

FIGURE #: 4-9



LEGEND

MW-50B 0.28 — MONITORING WELL LOCATION AND GROUNDWATER ELEVATION IN MSL (NGVD OF 1929)

GROUNDWATER CONTOUR (10 FT.)

INFERRED GROUNDWATER CONTOUR (10 FT.)

GENERAL FLOW DIRECTION OF OVERBURDEN GROUNDWATER

AREA BOUNDARIES

NOTE: THE OBSERVED GAP BETWEEN THE 10 FOOT AND 0 FOOT CONTOUR LINE IS A RESULT OF TOPOGRAPHIC AND HYDROLOGIC DIFFERENCES BETWEEN THE NORTHERN AND SOUTHERN PORTIONS OF THE FORMER ARSENAL. LARGE DIFFERENCES IN GROUNDWATER ELEVATIONS BETWEEN WELLS IN THE NORTHERN PORTION OF THER FORMER ARSENAL LIMITED WESTON'S CHOICE ON A CONTOUR INTERVAL.

GROUNDWATER LEVEL MEASUREMENTS WERE OBTAINED FROM 140 EXISTING OR PHASE II RI MONITORING WELLS. (SEE TABLE 3-13). ONLY OVERBURDEN MONITORING WELLS THAT ARE SCREENED IN THE LOWER SAND AQUIFER ARE POSTED WITH A WATER LEVEL MEASUREMENT (REDUCED IN MSL NGVD OF 1929). ALL OTHER OVERBURDEN WELLS THAT ARE SCREENED ACROSS MORE THAN ONE HYDROLOGIC UNIT WERE NOT POSTED, BECAUSE THEY ARE NOT REPRESENTATIVE OF WATER LEVELS WITHIN THE LOWER SAND AQUIFER. ONLY THE DEEPER WELL OF A WELL CLUSTER IS SHOWN.

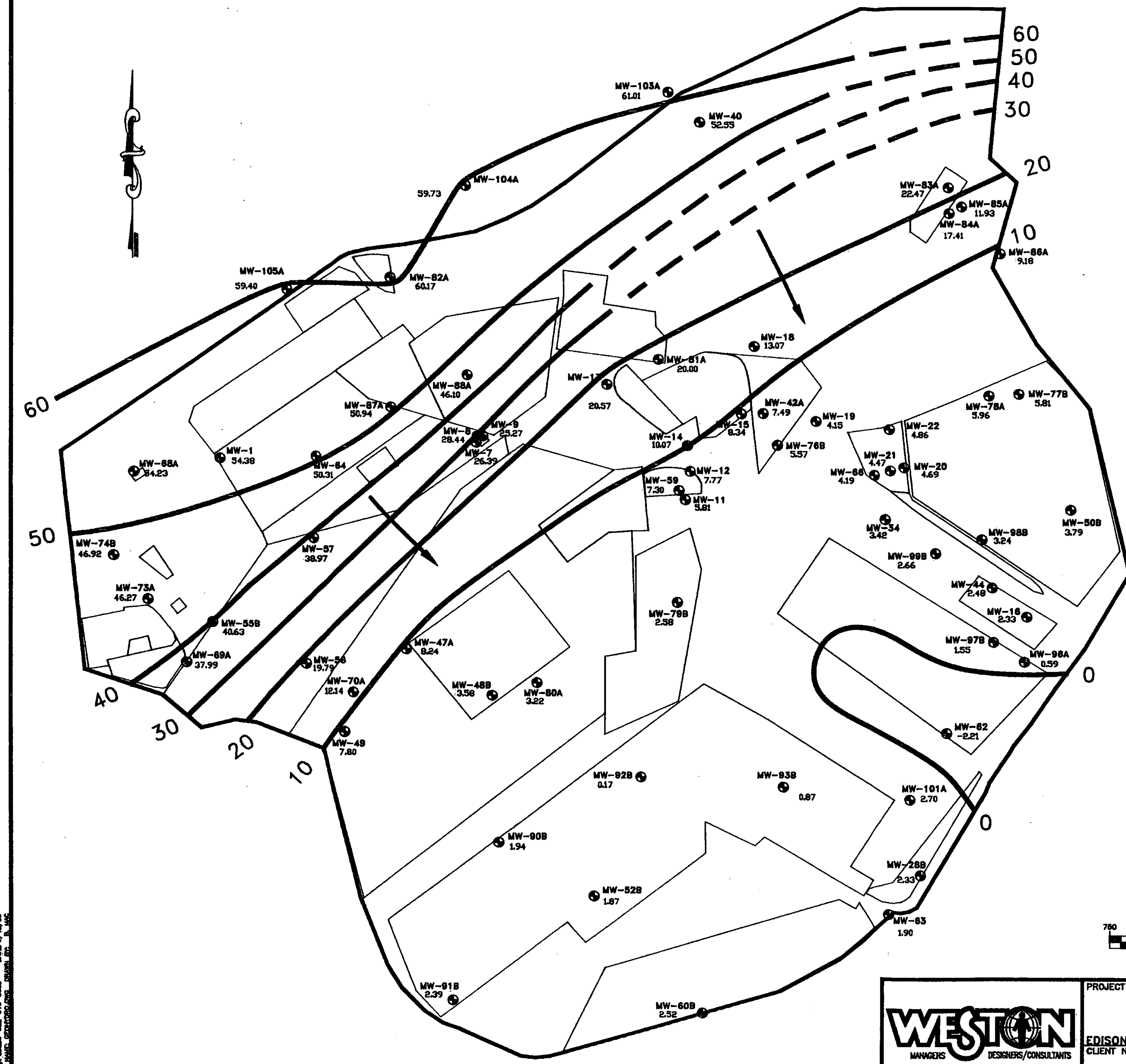
WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

OVERBURDEN GROUNDWATER CONTOUR MAP 3 NOVEMBER 1994

DATE: JUNE 1995

FIGURE #: 4-10



LEGEND

MW-50B 3.79 — MONITORING WELL LOCATIONS AND GROUNDWATER ELEVATION IN MSL (NGVD OF 1929)

GROUNDWATER CONTOUR (10 FT.)

INFERRED GROUNDWATER CONTOUR (10 FT.)

GENERAL FLOW DIRECTION OF OVERBURDEN GROUNDWATER

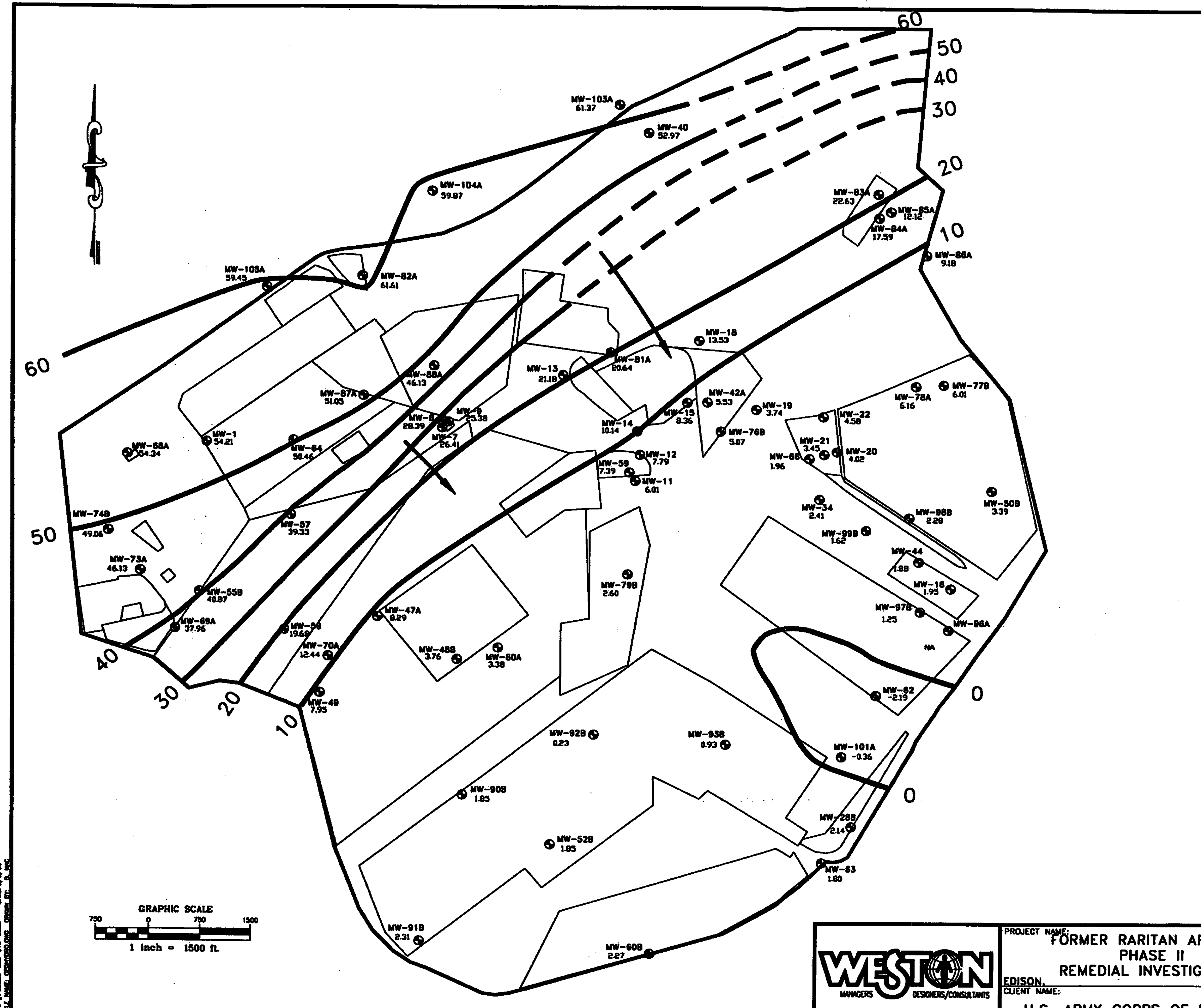
AREA BOUNDARIES

NOTES: GROUNDWATER MEASUREMENTS WERE COLLECTED DURING HIGH TIDE

THE OBSERVED GAP BETWEEN THE 10 FOOT AND 0 FOOT CONTOUR LINE IS A RESULT OF TOPOGRAPHIC AND HYDROLOGIC DIFFERENCES BETWEEN THE NORTHERN AND SOUTHERN PORTIONS OF THE FORMER ARSENAL. LARGE DIFFERENCES IN GROUNDWATER ELEVATIONS BETWEEN WELLS IN THE NORTHERN PORTION OF THE FORMER ARSENAL, LIMITED WESTON'S CHOICE ON A CONTOUR INTERVAL.

GROUNDWATER LEVEL MEASUREMENTS WERE OBTAINED FROM 140 EXISTING OR PHASE II RI MONITORING WELLS. (SEE TABLE 3-13). ONLY OVERBURDEN MONITORING WELLS THAT ARE SCREENED IN THE LOWER SAND AQUIFER ARE POSTED WITH A WATER LEVEL MEASUREMENT (REDUCED IN MSL NGVD OF 1929). ALL OTHER OVERBURDEN WELLS THAT ARE SCREENED ACROSS MORE THAN ONE HYDROLOGIC UNIT WERE NOT POSTED, BECAUSE THEY ARE NOT REPRESENTATIVE OF WATER LEVELS WITHIN THE LOWER SAND AQUIFER. ONLY THE DEEPER WELL OF A WELL CLUSTER IS SHOWN.

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	OVERBURDEN GROUNDWATER CONTOUR MAP 19 JANUARY 1995
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: JUNE 1995 — FIGURE #: 4-11



LEGEND

MW-50B 3.39 — MONITORING WELL LOCATION AND GROUNDWATER ELEVATION IN MSL (NGVD OF 1929)

GROUNDWATER CONTOUR (10 FT.)

INFERRED GROUNDWATER CONTOUR (10 FT.)

GENERAL FLOW DIRECTION OF OVERBURDEN GROUNDWATER

AREA BOUNDARIES

NOTES: GROUNDWATER MEASUREMENTS WERE COLLECTED DURING HIGH TIDE

THE OBSERVED GAP BETWEEN THE 10 FOOT AND 0 FOOT CONTOUR LINE IS A RESULT OF TOPOGRAPHIC AND HYDROLOGIC DIFFERENCES BETWEEN THE NORTHERN AND SOUTHERN PORTIONS OF THE FORMER ARSENAL. LARGE DIFFERENCES IN GROUNDWATER ELEVATIONS BETWEEN WELLS IN THE NORTHERN PORTION OF THE FORMER ARSENAL, LIMITED WESTON'S CHOICE ON A CONTOUR INTERVAL.

GROUNDWATER LEVEL MEASUREMENTS WERE OBTAINED FROM 140 EXISTING OR PHASE II RI MONITORING WELLS. (SEE TABLE 3-13). ONLY OVERBURDEN MONITORING WELLS THAT ARE SCREENED IN THE LOWER SAND AQUIFER ARE POSTED WITH A WATER LEVEL MEASUREMENT (REDUCED IN MSL NGVD OF 1929). ALL OTHER OVERBURDEN WELLS THAT ARE SCREENED ACROSS MORE THAN ONE HYDROLOGIC UNIT WERE NOT POSTED, BECAUSE THEY ARE NOT REPRESENTATIVE OF WATER LEVELS WITHIN THE LOWER SAND AQUIFER. ONLY THE DEEPER WELL OF A WELL CLUSTER IS SHOWN.

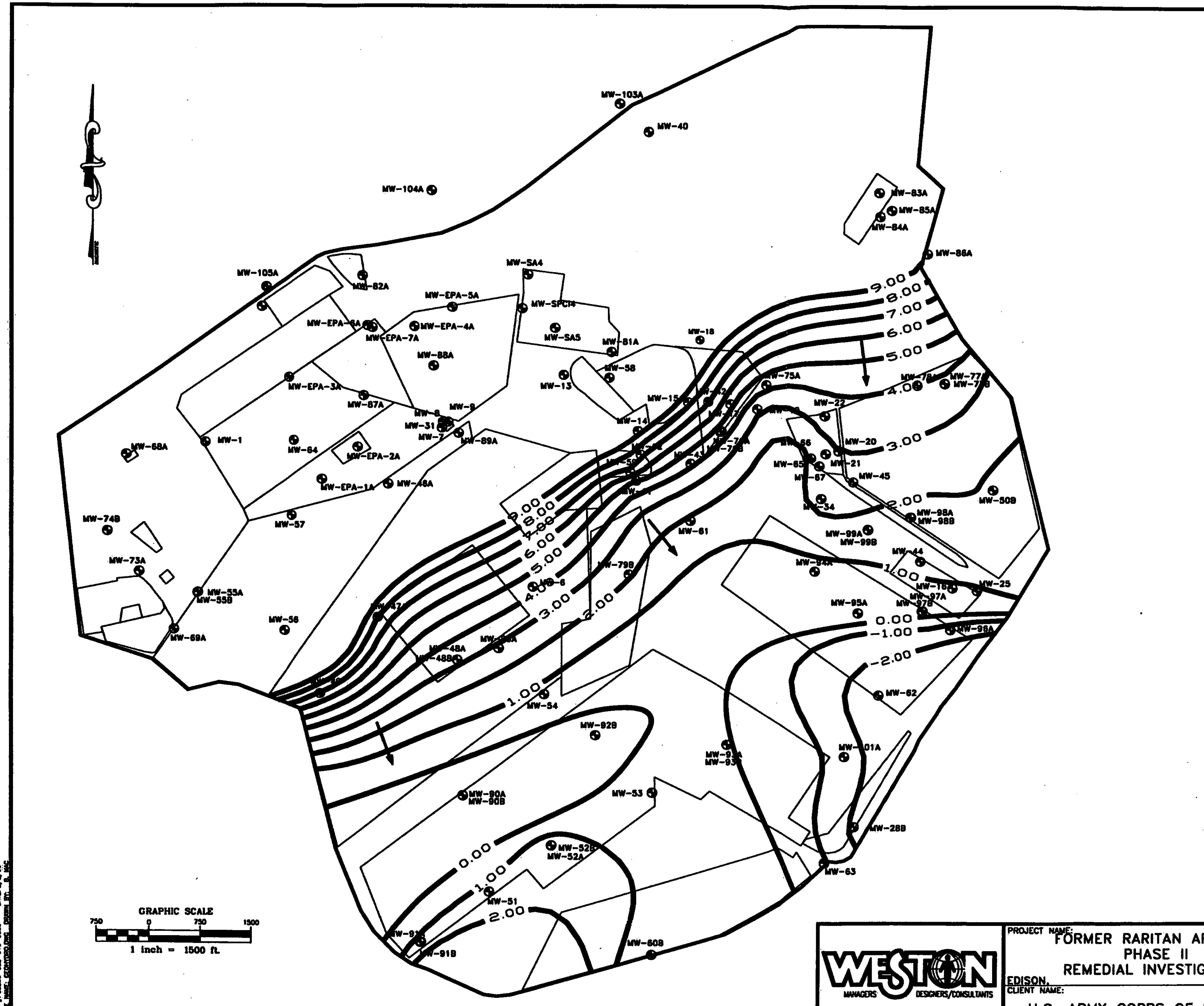
WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

OVERBURDEN GROUNDWATER CONTOUR MAP 16 MARCH 1995

DATE: MAY 1996

FIGURE #: 4-12



LEGEND

MW-93A ⊕ MONITORING WELL LOCATION

AREA BOUNDARIES

GENERAL FLOW DIRECTION OF GROUNDWATER (LOWER SAND AQUIFER)

ONE FOOT CONTOUR INTERVAL (IN FT. MSL)

NOTES: GROUNDWATER LEVEL MEASUREMENTS WERE OBTAINED FROM 140 EXISTING OR PHASE II RI MONITORING WELLS. (SEE TABLE 3-13). ONLY OVERBURDEN MONITORING WELLS THAT ARE SCREENED IN THE LOWER SAND AQUIFER ARE POSTED WITH A WATER LEVEL MEASUREMENT (REDUCED IN MSL NGVD OF 1929). ALL OTHER OVERBURDEN WELLS THAT ARE SCREENED ACROSS MORE THAN ONE HYDROLOGIC UNIT WERE NOT POSTED, BECAUSE THEY ARE NOT REPRESENTATIVE OF WATER LEVELS WITHIN THE LOWER SAND AQUIFER. ONLY THE DEEPER WELL OF A WELL CLUSTER IS SHOWN.

GROUNDWATER CONTOUR MAPS WERE GENERATED USING SURFER CONTOURING SOFTWARE. THE CONTOURS WERE TRUNCATED AT THE SITE BOUNDARIES. MONITORING WELLS UTILIZED, REFLECT ONLY LOWER SAND WELLS IN THE SOUTHERN HYDROLOGIC ZONE.

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	SOUTHERN ZONE OVERBURDEN GROUNDWATER CONTOUR MAP 3 NOVEMBER 1994	
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: MAY 1996	FIGURE #: 4-13

LEGEND

MW-93A ⊕ MONITORING WELL LOCATION

AREA BOUNDARIES

GENERAL FLOW DIRECTION OF GROUNDWATER (LOWER SAND AQUIFER)

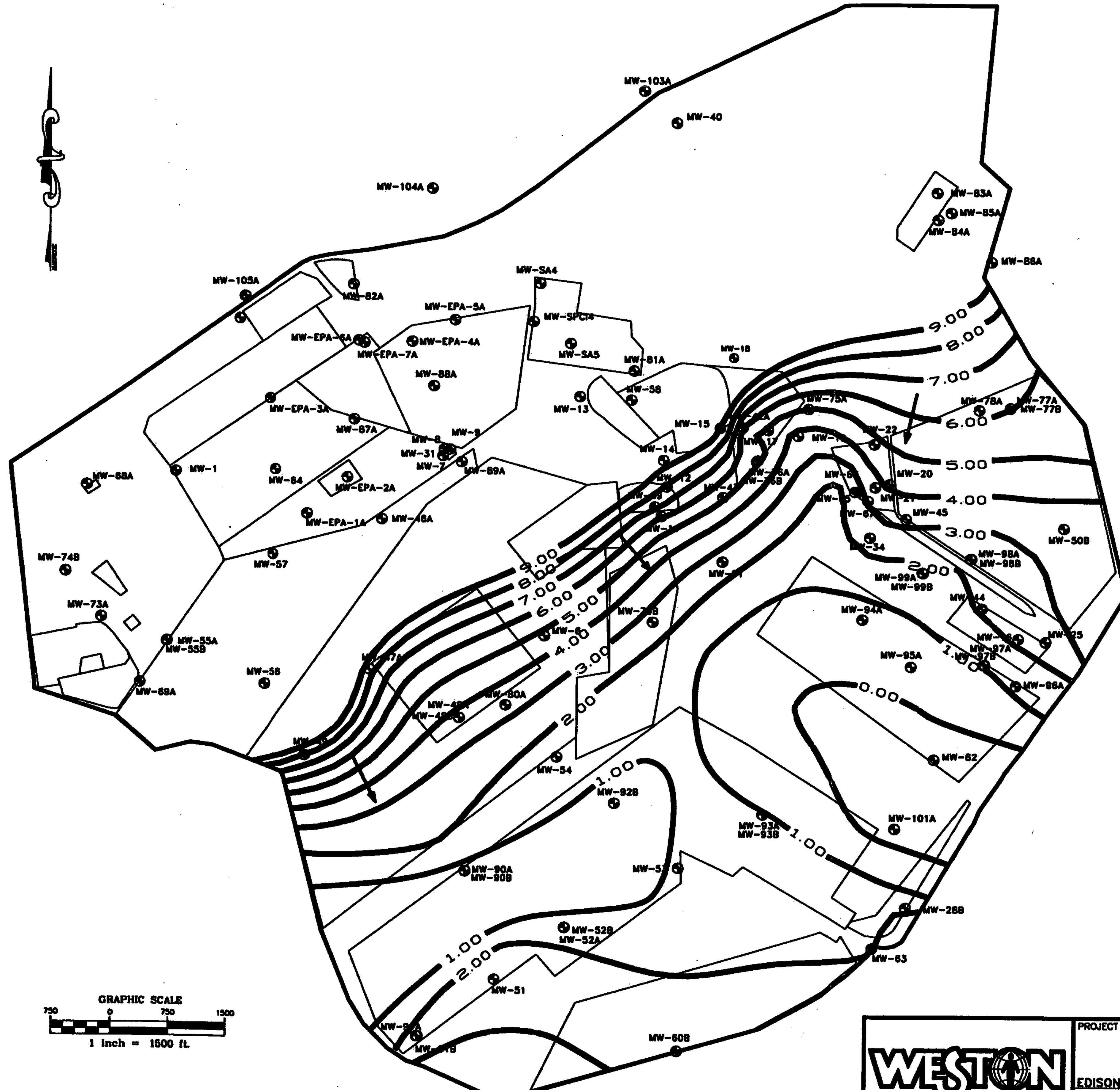
ONE FOOT CONTOUR INTERVAL (IN FT. MSL)

NOTES: GROUNDWATER MEASUREMENTS WERE COLLECTED DURING HIGH TIDE.

GROUNDWATER LEVEL MEASUREMENTS WERE OBTAINED FROM 140 EXISTING OR PHASE II RI MONITORING WELLS. (SEE TABLE 3-13). ONLY OVERBURDEN MONITORING WELLS THAT ARE SCREENED IN THE LOWER SAND AQUIFER ARE POSTED WITH A WATER LEVEL MEASUREMENT (REDUCED IN MSL NGVD OF 1929). ALL OTHER OVERBURDEN WELLS THAT ARE SCREENED ACROSS MORE THAN ONE HYDROLOGIC UNIT WERE NOT POSTED, BECAUSE THEY ARE NOT REPRESENTATIVE OF WATER LEVELS WITHIN THE LOWER SAND AQUIFER. ONLY THE DEEPER WELL OF A WELL CLUSTER IS SHOWN.

GROUNDWATER CONTOUR MAPS WERE GENERATED USING SURFER CONTOURING SOFTWARE. THE CONTOURS WERE TRUNCATED AT THE SITE BOUNDRIES. MONITORING WELLS UTILIZED, REFLECT ONLY LOWER SAND WELLS IN THE SOUTHERN HYDROLOGIC ZONE.

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	SOUTHERN ZONE OVERBURDEN GROUNDWATER CONTOUR MAP 19 JANUARY 1995
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: MAY 1996 — FIGURE #: 4-14



GRAPHIC SCALE

750 0 750 1500

1 inch = 1500 ft.

LEGEND

MW-93A MONITORING WELL LOCATION

AREA BOUNDARIES

GENERAL FLOW DIRECTION OF GROUNDWATER (LOWER SAND AQUIFER)

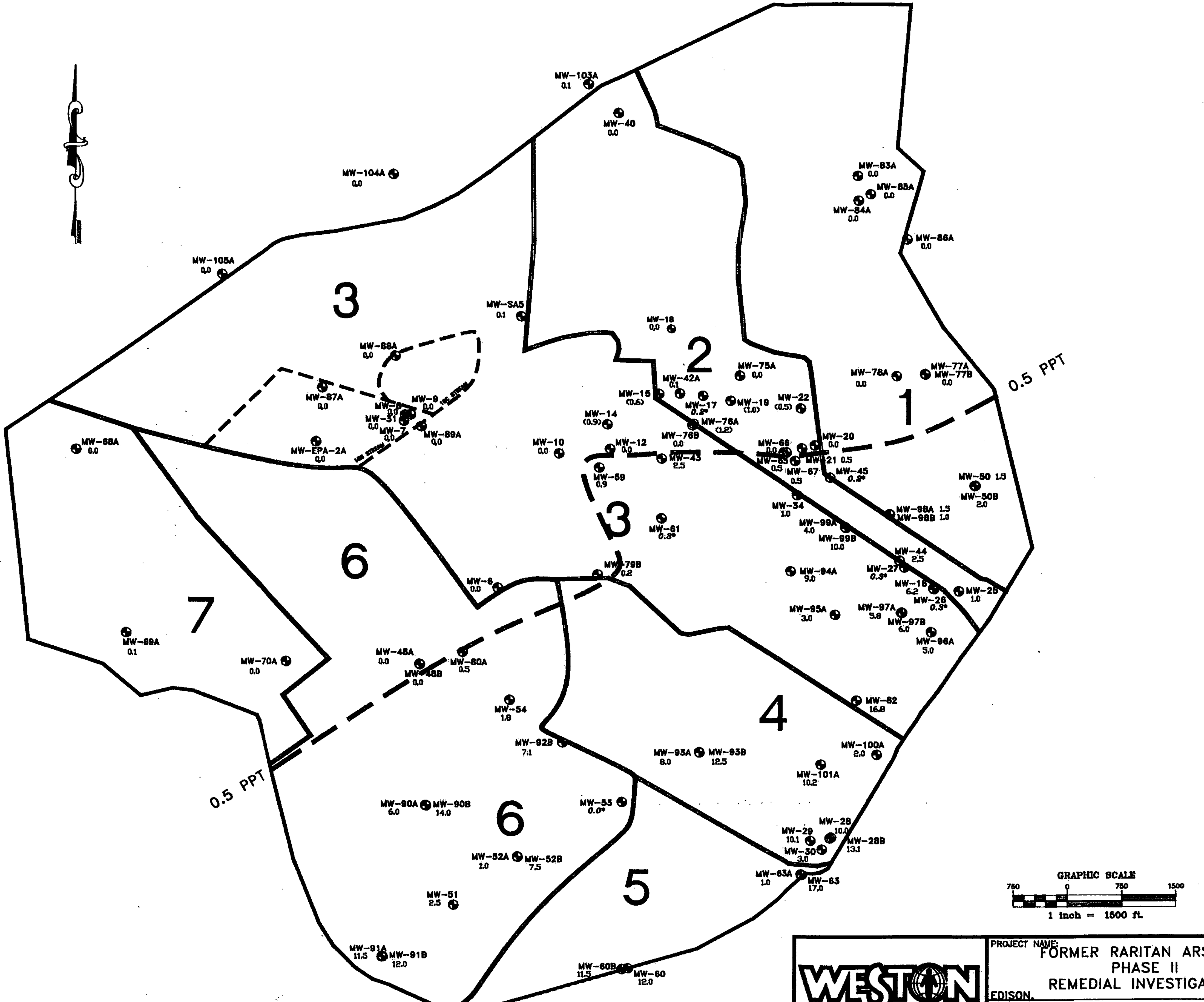
ONE FOOT CONTOUR INTERVAL (IN FT. MSL)

NOTES: GROUNDWATER MEASUREMENTS WERE COLLECTED DURING HIGH TIDE.

GROUNDWATER LEVEL MEASUREMENTS WERE OBTAINED FROM 140 EXISTING OR PHASE II RI MONITORING WELLS. (SEE TABLE 3-13). ONLY OVERBURDEN MONITORING WELLS THAT ARE SCREENED IN THE LOWER SAND AQUIFER ARE POSTED WITH A WATER LEVEL MEASUREMENT (REDUCED IN MSL NGVD OF 1929). ALL OTHER OVERBURDEN WELLS THAT ARE SCREENED ACROSS MORE THAN ONE HYDROLOGIC UNIT WERE NOT POSTED, BECAUSE THEY ARE NOT REPRESENTATIVE OF WATER LEVELS WITHIN THE LOWER SAND AQUIFER. ONLY THE DEEPER WELL OF A WELL CLUSTER IS SHOWN.

GROUNDWATER CONTOUR MAPS WERE GENERATED USING SURFER CONTOURING SOFTWARE. THE CONTOURS WERE TRUNCATED AT THE SITE BOUNDRIES. MONITORING WELLS UTILIZED, REFLECT ONLY LOWER SAND WELLS IN THE SOUTHERN HYDROLOGIC ZONE.

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	SOUTHERN ZONE OVERBURDEN GROUNDWATER CONTOUR MAP 16 MARCH 1995
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: MAY 1996 / FIGURE #: 4-15



LEGEND

MW-50 1.5	MONITORING WELL LOCATION & SALINITY MEASUREMENT (IN PARTS PER THOUSAND)
NM	NOT MEASURED
	DRAINAGE BOUNDARY
	SUBDRAINAGE BOUNDARY
	ESTIMATED BOUNDARY BETWEEN FRESH & SALINE GROUNDWATER. FRESHWATER IS ≤ 0.5 PPT, SALINE WATER IS > 0.5 PPT.

NOTES: SALINITY DATA IS BASED ON FINAL PURGE DATA OBTAINED DURING THE ROUND 1 GROUNDWATER SAMPLING EVENT. IF SALINITY MEASUREMENTS WERE NOT OBTAINED DURING THE ROUND 1 SAMPLING EVENT, ROUND 2 SALINITY DATA WAS USED. SEE TABLE 3-5 FOR A SUMMARY OF ROUND 1 AND ROUND 2 SALINITY DATA. BOUNDARY BETWEEN FRESH AND SALINE GROUNDWATER – 500 MG/L (0.5 PPT) IS BASED ON N.J.A.C.-7:9-6 DATE JANUARY 7, 1993 TDS STANDARD. TDS IS DEFINED AS "THE CONCENTRATION OF MINERALS IN WATER. THE DISSOLVED MINERALS ARE CLASSIFIED AS INORGANIC SALTS, THUS THE TERM 'SALINITY' IS ANOTHER WAY TO DESCRIBE MINERAL CONCENTRATION OR SALINITY OF THE WATER.

DRAINAGE AREA BOUNDARY NAMES ARE PRESENTED ON FIGURE 4-22.

1.5 * SOME LOCATIONS THAT ARE SCREENED WITHIN THE UPPER SAND, MEADOWMAT, AND UPPER PORTIONS OF THE LOWER SAND HYDROLOGIC UNITS HAVE BEEN OMITTED FROM THIS FIGURE. THESE LOCATIONS DO NOT REPRESENT TRUE LOWER SAND HYDROLOGIC UNIT CONDITIONS.

( ) WELL LOCATIONS MW-14, MW-15, MW-19, MW-22, AND MW-84A HAVE NOT BEEN INCLUDED IN THIS SALINE WATER ZONE. THESE LOCATIONS ALTHOUGH MEET THE REQUIREMENTS OF 0.5 PPT COULD NOT BE CONTOURED WITH A REASONABLE DEGREE OF CONFIDENCE.

WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION

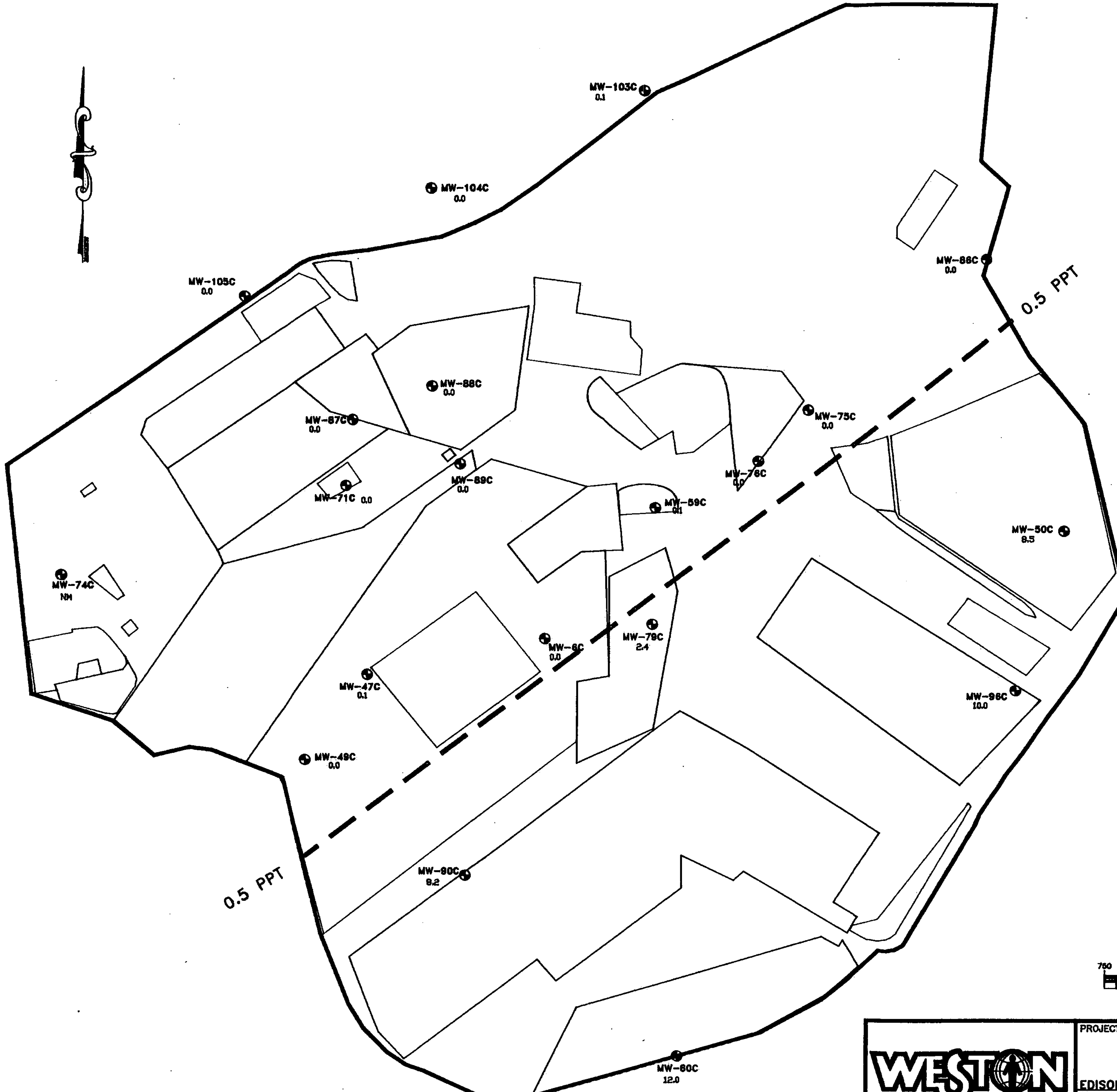
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

DISTRIBUTION OF SALINITY IN OVERBURDEN GROUNDWATER

DATE: JUNE 1995

FIGURE #: 4-16



LEGEND

MW-50C 8.5 — MONITORING WELL LOCATION & SALINITY MEASUREMENT (IN PARTS PER THOUSAND)

NM — NOT MEASURED

ESTIMATED BOUNDARY BETWEEN FRESH & SALINE GROUNDWATER. FRESHWATER IS ≤ 0.5 PPT, SALINE WATER IS > 0.5 PPT.

NOTE: SALINITY DATA IS BASED ON FINAL PURGE DATA OBTAINED DURING THE ROUND 1 GROUNDWATER SAMPLING EVENT. IF SALINITY MEASUREMENTS WERE NOT OBTAINED DURING THE ROUND 1 SAMPLING EVENT, ROUND 2 SALINITY DATA WAS USED. SEE TABLE 3-5 FOR A SUMMARY OF ROUND 1 AND ROUND 2 SALINITY DATA. BOUNDARY BETWEEN FRESH AND SALINE GROUNDWATER - 500 MG/L (0.5 PPT) IS BASED ON N.J.A.C.-7:9-6.6 DATE JANUARY 7, 1993 TDS STANDARD. TDS IS DEFINED AS "THE CONCENTRATION OF MINERALS IN WATER. THE DISSOLVED MINERALS ARE CLASSIFIED AS INORGANIC SALTS, THUS THE TERM 'SALINITY' IS ANOTHER WAY TO DESCRIBE MINERAL CONCENTRATION OR SALINITY OF THE WATER.

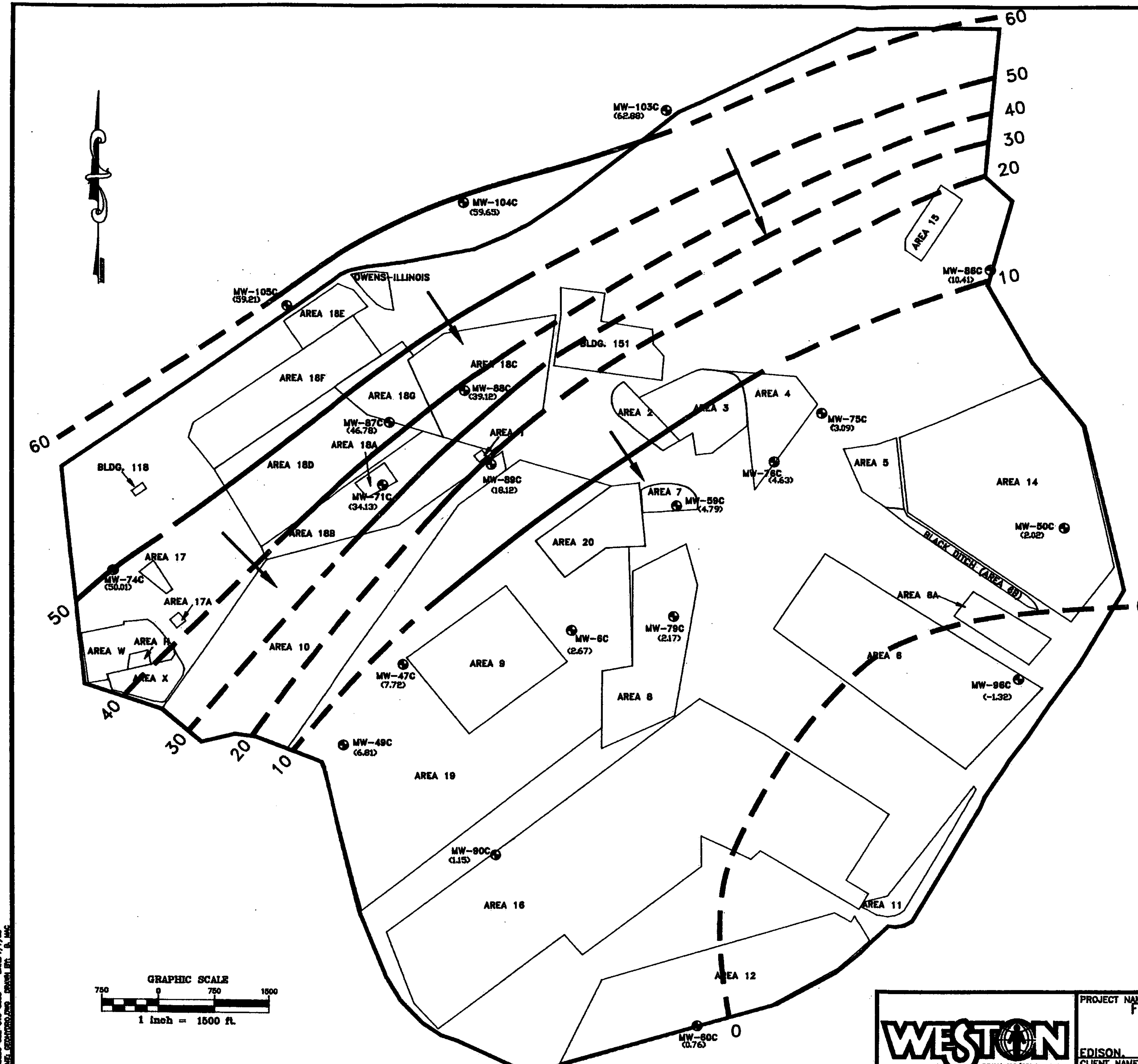
GRAPHIC SCALE
750 0 750 1500
1 inch = 1500 ft.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

DISTRIBUTION OF SALINITY IN BEDROCK GROUNDWATER

DATE: JUNE 1995
FIGURE #: 4-17



LEGEND

GROUNDWATER CONTOUR (10 FT.)

INFERRED GROUNDWATER CONTOUR (10 FT.)

MW-105C (59.21) BEDROCK MONITORING WELL LOCATION AND BEDROCK GROUNDWATER ELEVATION (IN FT. MSL NGVD OF 1929)

AREA BOUNDARIES

GENERAL FLOW DIRECTION OF BEDROCK GROUNDWATER

NOTE: THE OBSERVED GAP BETWEEN THE 10 FOOT AND 0 FOOT CONTOUR LINE IS A RESULT OF TOPOGRAPHIC AND HYDROLOGIC DIFFERENCES BETWEEN THE NORTHERN AND SOUTHERN PORTIONS OF THE FORMER ARSENAL. LARGE DIFFERENCES IN GROUNDWATER ELEVATIONS BETWEEN WELLS IN THE NORTHERN PORTION OF THE FORMER ARSENAL LIMITED WESTON'S CHOICE ON A CONTOUR INTERVAL.

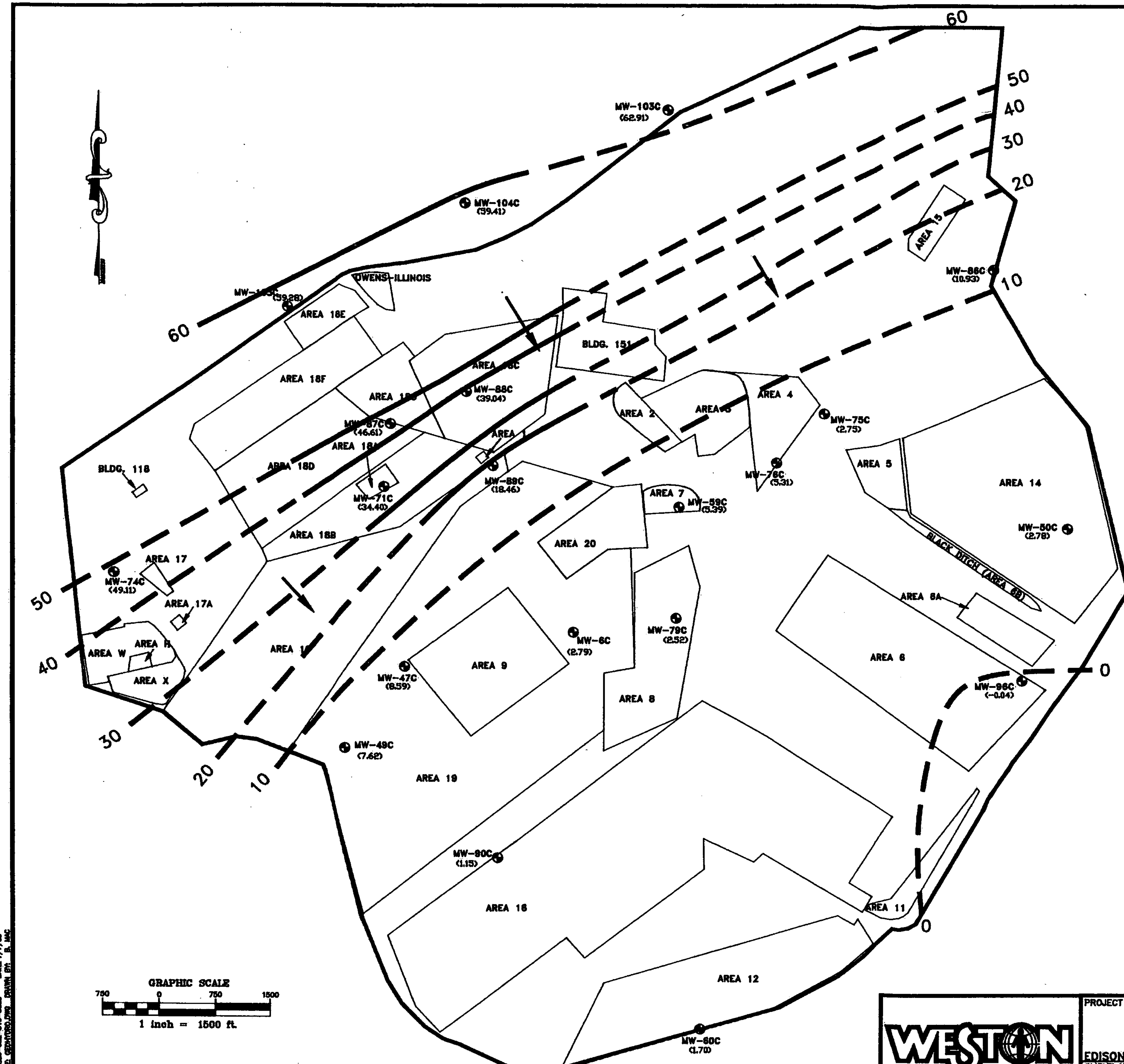
WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

BEDROCK GROUNDWATER CONTOUR MAP 3 NOVEMBER 1994

DATE: JUNE 1995

FIGURE #: 4-18



LEGEND

GROUNDWATER CONTOUR (10 FT.)

INFERRED GROUNDWATER CONTOUR (10 FT.)

MW-50C (2.78) BEDROCK MONITORING WELL LOCATION AND BEDROCK GROUNDWATER ELEVATION (IN FT. MSL NGVD OF 1929)

AREA BOUNDARIES

GENERAL FLOW DIRECTION OF BEDROCK GROUNDWATER

NOTES: THE OBSERVED GAP BETWEEN THE 10 FOOT AND 0 FOOT CONTOUR LINE IS A RESULT OF TOPOGRAPHIC AND HYDROLOGIC DIFFERENCES BETWEEN THE NORTHERN AND SOUTHERN PORTIONS OF THE FORMER ARSENAL. LARGE DIFFERENCES IN GROUNDWATER ELEVATIONS BETWEEN WELLS IN THE NORTHERN PORTION OF THE FORMER ARSENAL LIMITED WESTON'S CHOICE ON A CONTOUR INTERVAL.

GROUNDWATER MEASUREMENTS WERE COLLECTED DURING HIGH TIDE.

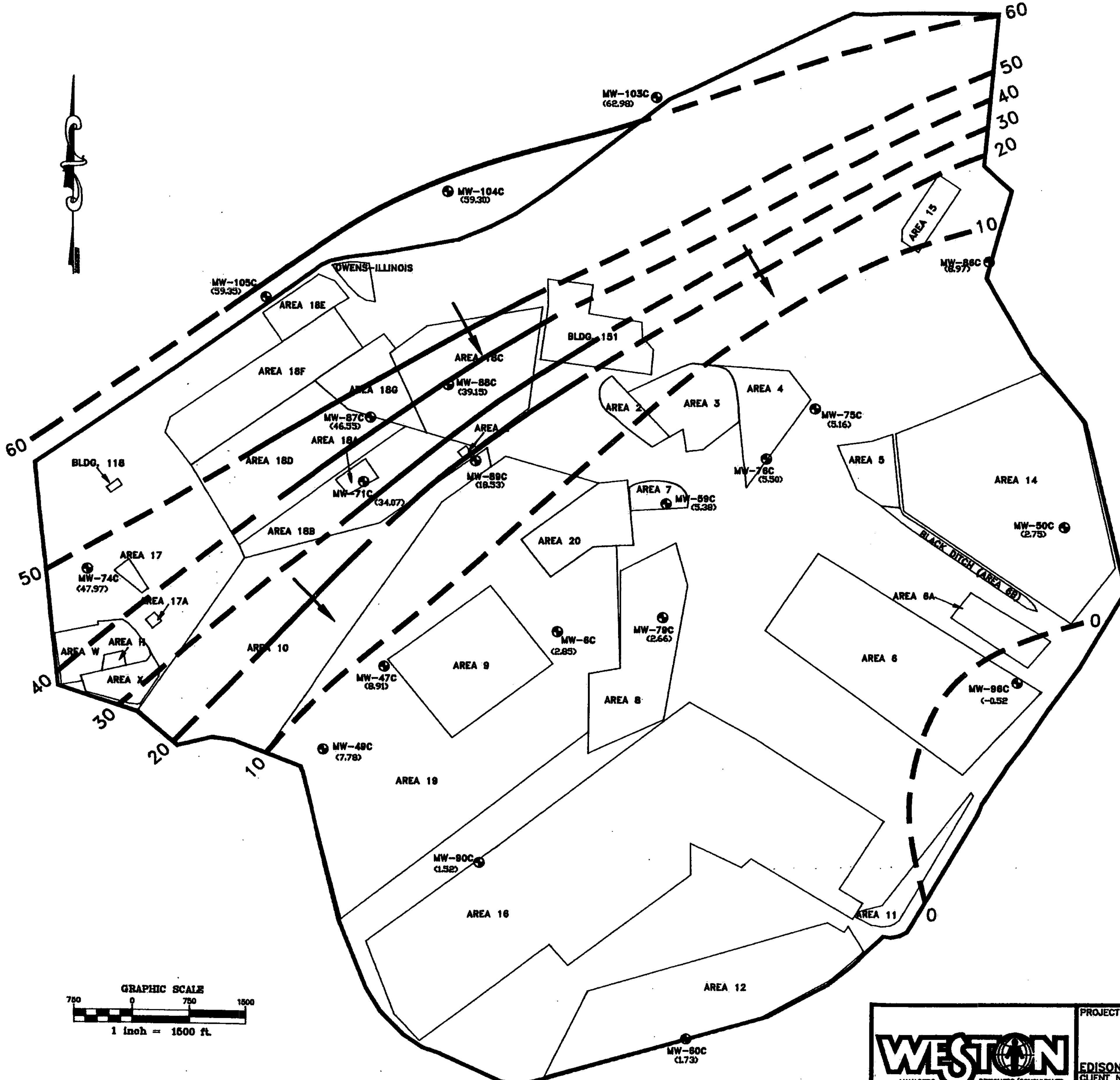
WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

BEDROCK GROUNDWATER CONTOUR MAP 19 JANUARY 1995

DATE: JUNE 1995

FIGURE #: 4-19



LEGEND

GROUNDWATER CONTOUR (10 FT.)

INFERRED GROUNDWATER CONTOUR (10 FT.)

MW-50C (2.75) BEDROCK MONITORING WELL LOCATION AND BEDROCK GROUNDWATER ELEVATION (IN FT. MSL NGVD OF 1929)

GENERAL FLOW DIRECTION OF BEDROCK GROUNDWATER

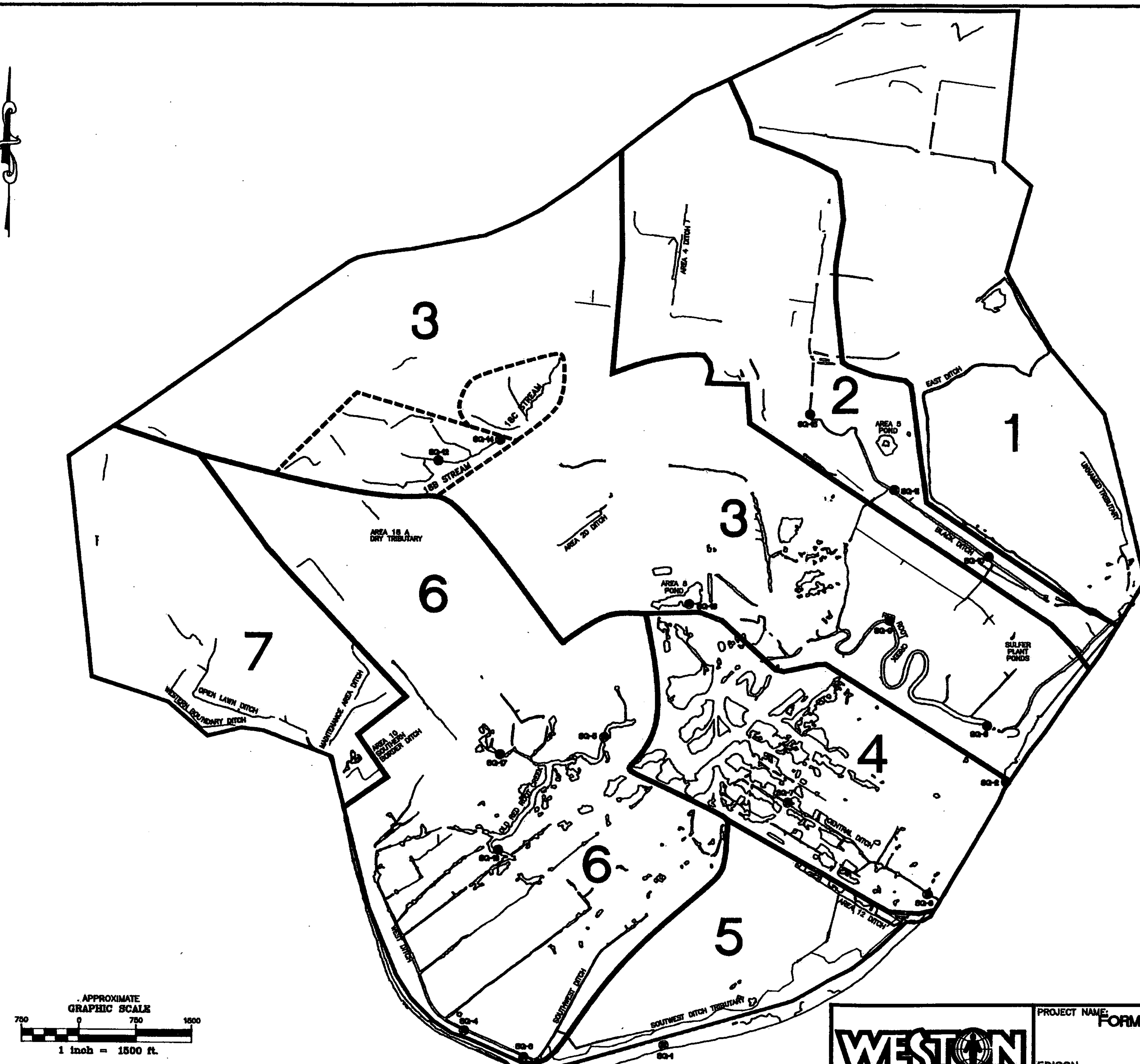
AREA BOUNDARIES

NOTES: GROUNDWATER MEASUREMENTS WERE COLLECTED DURING HIGH TIDE.

THE OBSERVED GAP BETWEEN THE 10 FOOT AND 0 FOOT CONTOUR LINE IS A RESULT OF TOPOGRAPHIC AND HYDROLOGIC DIFFERENCES BETWEEN THE NORTHERN AND SOUTHERN PORTIONS OF THE FORMER ARSENAL. LARGE DIFFERENCES IN GROUNDWATER ELEVATIONS BETWEEN WELLS IN THE NORTHERN PORTION OF THE FORMER ARSENAL LIMITED WESTON'S CHOICE ON A CONTOUR INTERVAL.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	BEDROCK GROUNDWATER CONTOUR MAP 16 MARCH 1995	
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: JUNE 1995	FIGURE #: 4-20



LEGEND

DRAINAGE BOUNDARY

SUBDRAINAGE BOUNDARY

1 EAST DITCH DRAINAGE AREA

2 BLACK DITCH DRAINAGE AREA

3 RED ROOT CREEK DRAINAGE AREA

4 CENTRAL DITCH DRAINAGE AREA

5 AREA 12 DRAINAGE AREA

6 OLD RED ROOT CREEK DRAINAGE AREA

7 COUNTY PARK DRAINAGE AREA

SG-2 STAFF GAUGE LOCATION

WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II

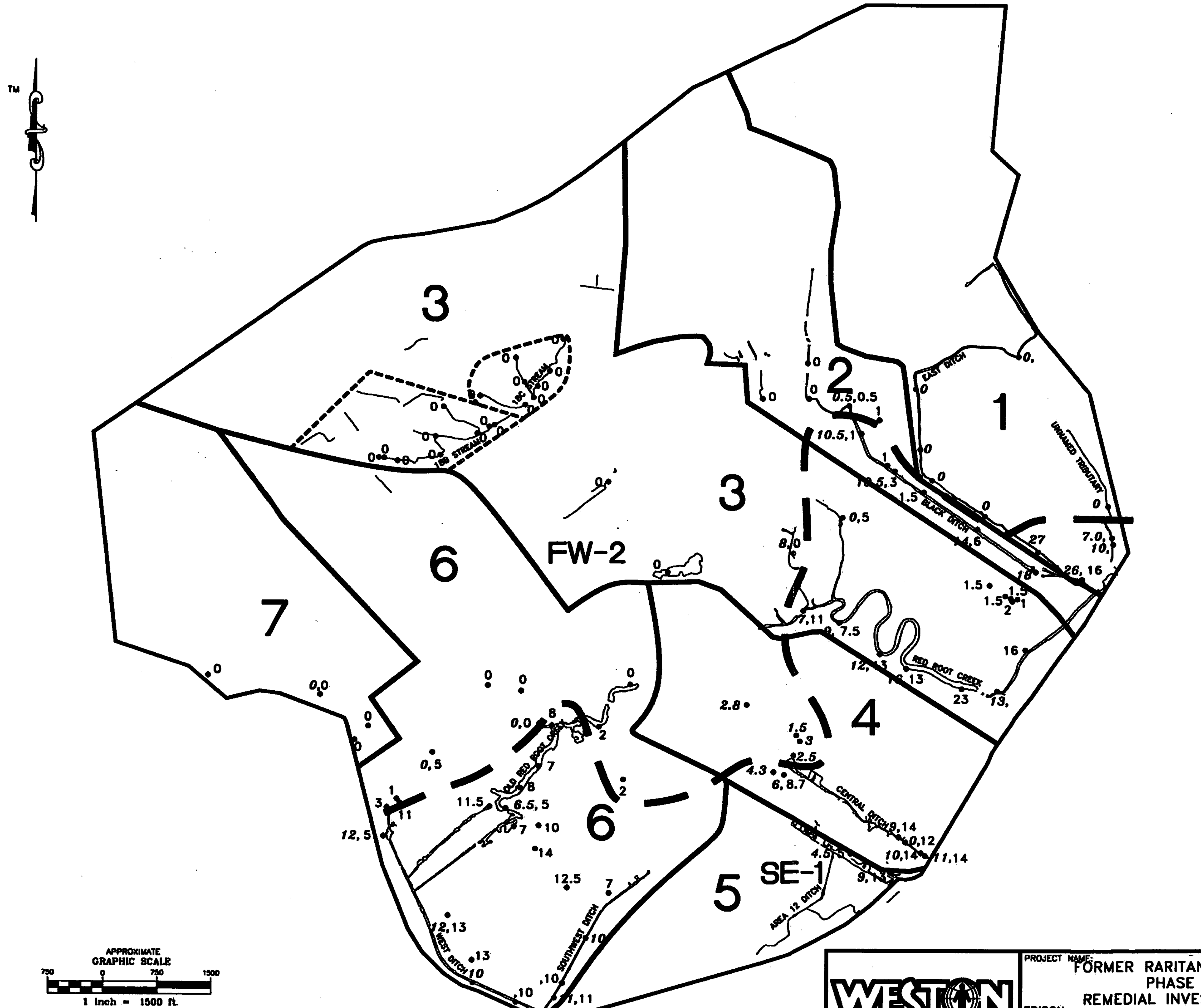
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

SURFACE WATER DRAINAGE AREA LOCATION MAP

DATE: JUNE 1995

FIGURE #: 4-21



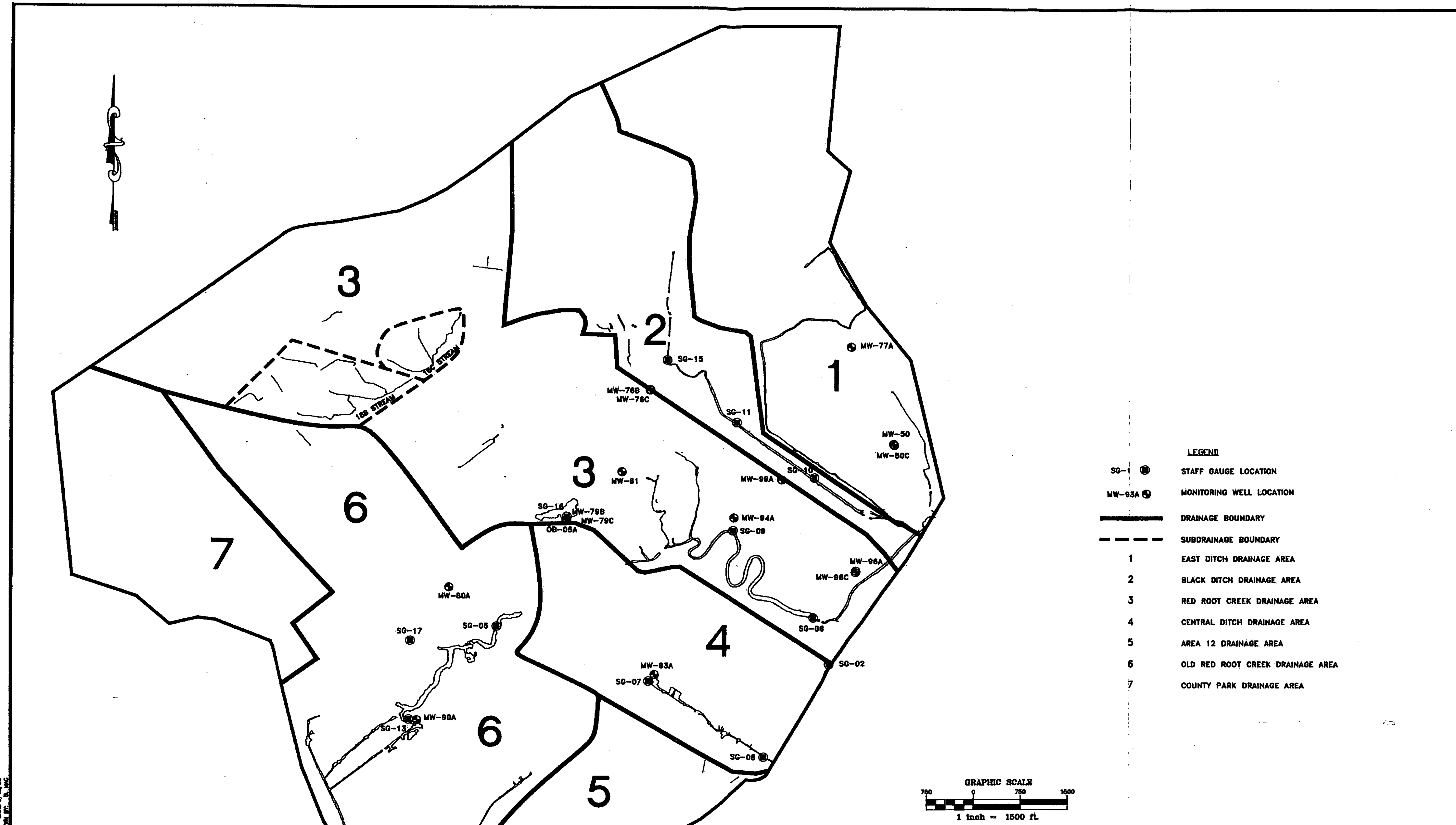
LEGEND

▬▬▬	DRAINAGE BOUNDARY
- - - -	SUBDRAINAGE BOUNDARY
1	EAST DITCH DRAINAGE AREA
2	BLACK DITCH DRAINAGE AREA
3	RED ROOT CREEK DRAINAGE AREA
4	CENTRAL DITCH DRAINAGE AREA
5	AREA 12 DRAINAGE AREA
6	OLD RED ROOT CREEK DRAINAGE AREA
7	COUNTY PARK DRAINAGE AREA
▬ ▬	BOUNDARY BETWEEN FW-2 AND SE-1 WATERS (1,2)
4.5, 5 •	SALINITY MEASUREMENTS IN PARTS PER THOUSAND (*HIGH TIDE*, LOW TIDE)
FW-2	FRESHWATER (≤ 3.5 PPT)
SE-1	ESTUARINE (> 3.5 PPT)

(1) BOUNDARY DETERMINED ON THE BASIS OF INCIDENTAL FIELD MEASUREMENTS TAKEN IN AUGUST 1994. REFER TO TEXT, AND APPENDIX A OF SITE-WIDE SURFACE WATER/SEDIMENT REPORT.

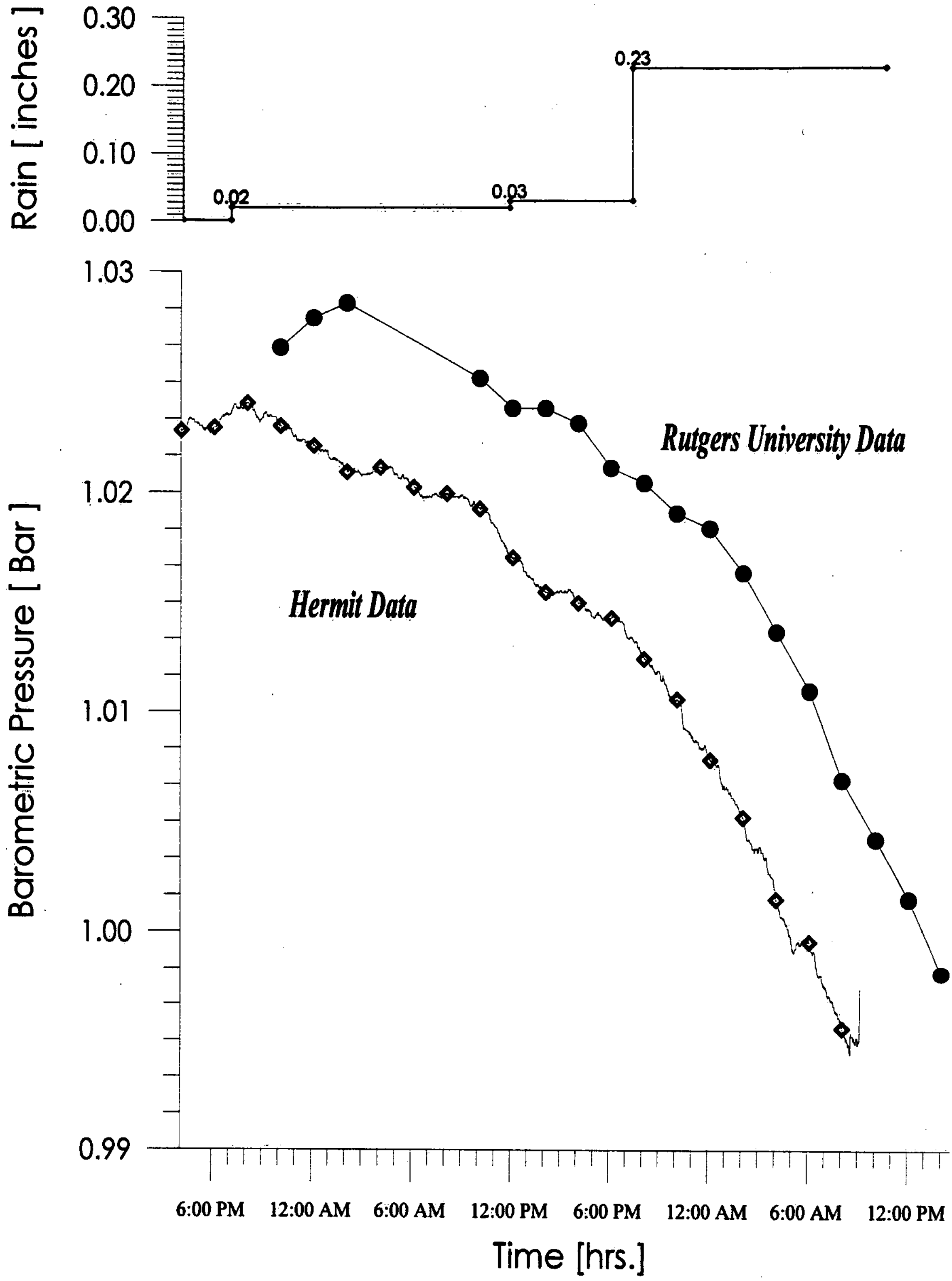
(2) REGULATORY DEFINITION OF SE-1 AND FW-2 FROM N.J.A.C. 7:9B

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	DISTRIBUTION OF SALINITY IN SURFACE WATER
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: MAY 1996 FIGURE #: 4-22



WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	TIDAL INFLUENCE INVESTIGATION MONITORING LOCATIONS	
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: JUNE 1995	FIGURE #: 4-23



WESTON
MANAGERS DESIGNERS/CONSULTANTS

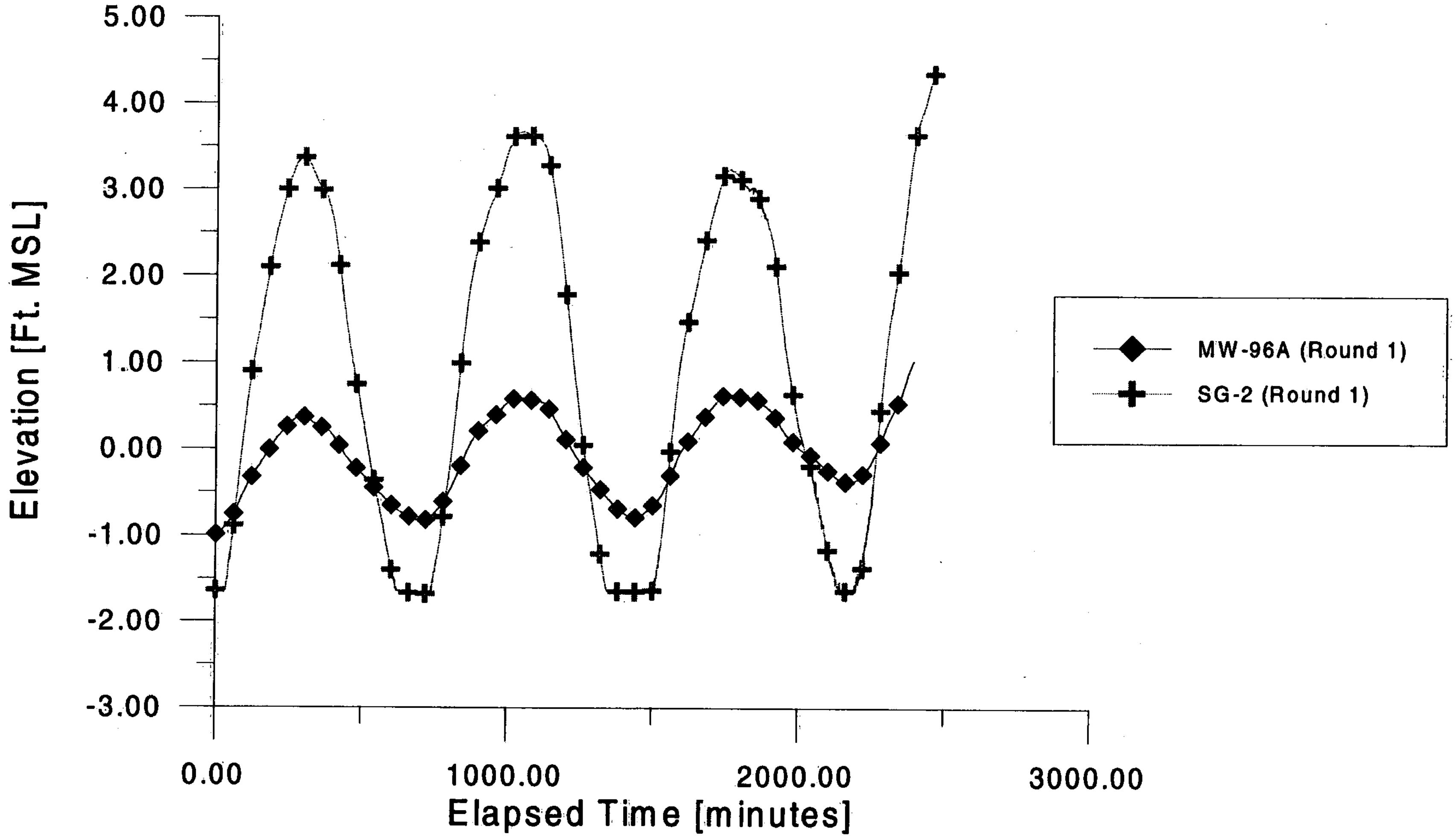
PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

ROUND 1
RAIN AND BAROMETRIC
PRESSURE DATA

DATE: JUNE 1995

FIGURE #: 4-24



WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

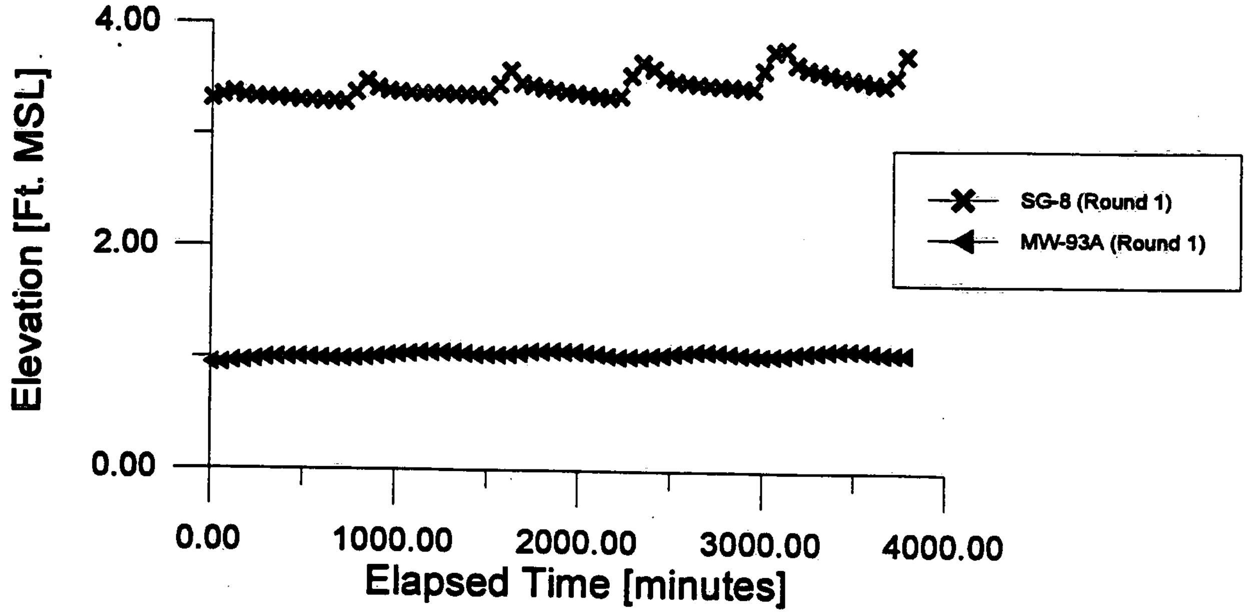
CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

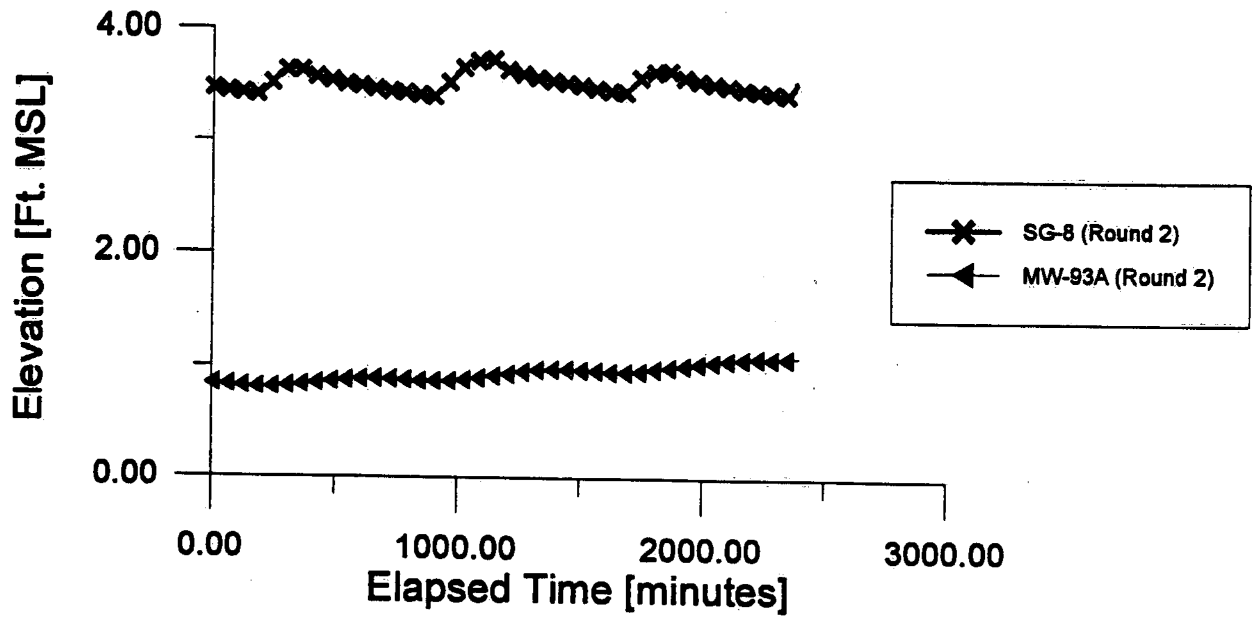
ROUND 1 COMPARISON
OF MW-96A TO SG-2
WATER LEVEL ELEVATIONS

DATE: JUNE 1995

FIGURE #: 4-25

REVISION #: 0000 DATE: 6/16/95
FILE NAME: TBLOCKS.DWG DRAWN BY: B. MAC





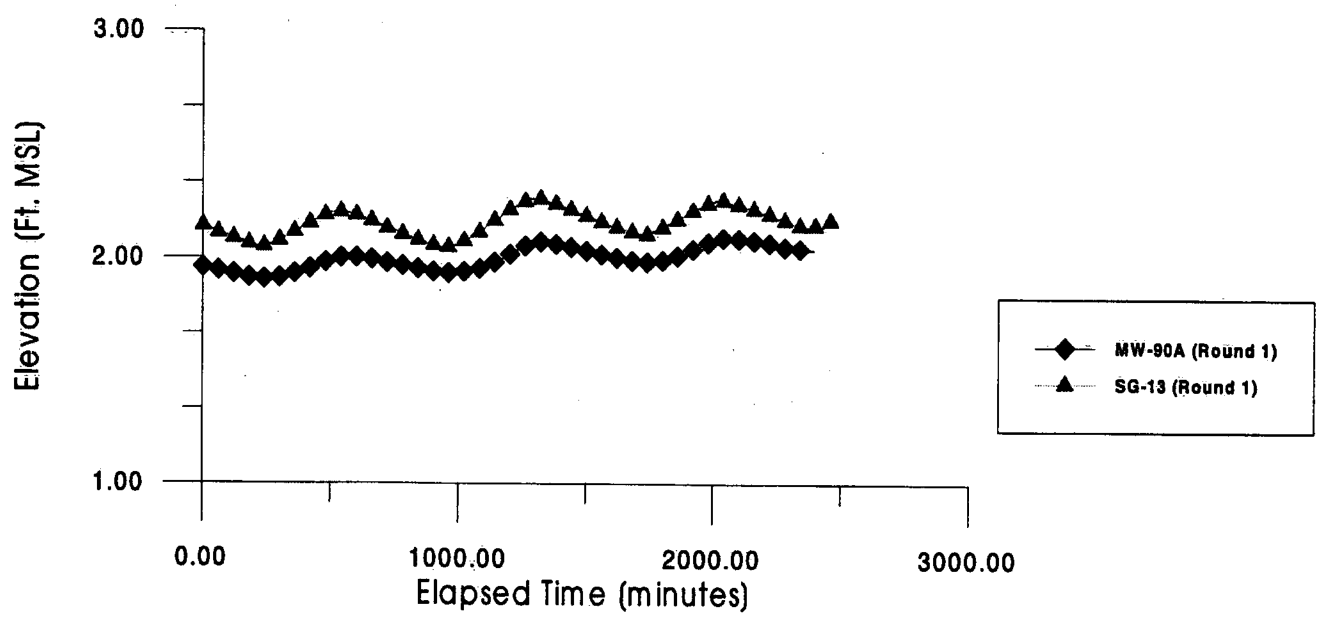
W.O. #: 03886-062-010-0005 DATE: 6/16/95
FILE NAME: TBLOCKS.DWG DRAWN BY: B. MAC

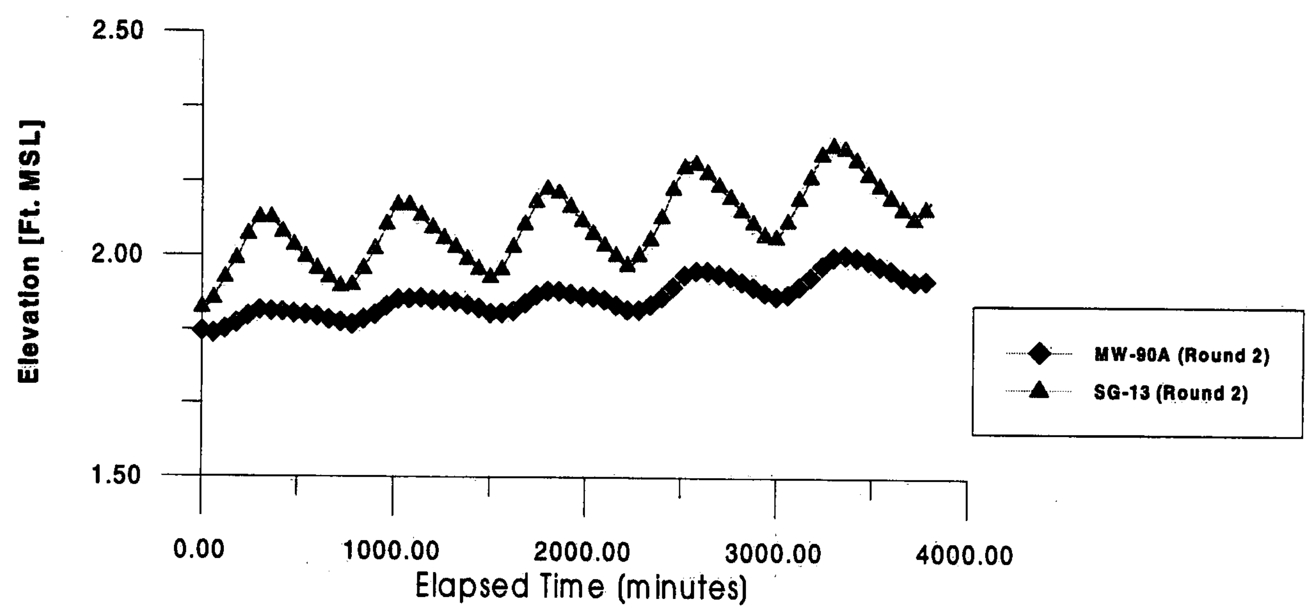
WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

ROUND 1 & 2 COMPARISON
OF MW-93A TO SG-8
WATER LEVEL ELEVATIONS

DATE: JUNE 1995
FIGURE #: 4-26





W.O. #: 03886-062-010-0005 DATE: 6/16/95
FILE NAME: TBLOCKS.DWG DRAWN BY: B. MAC

WESTON
MANAGERS DESIGNERS/CONSULTANTS

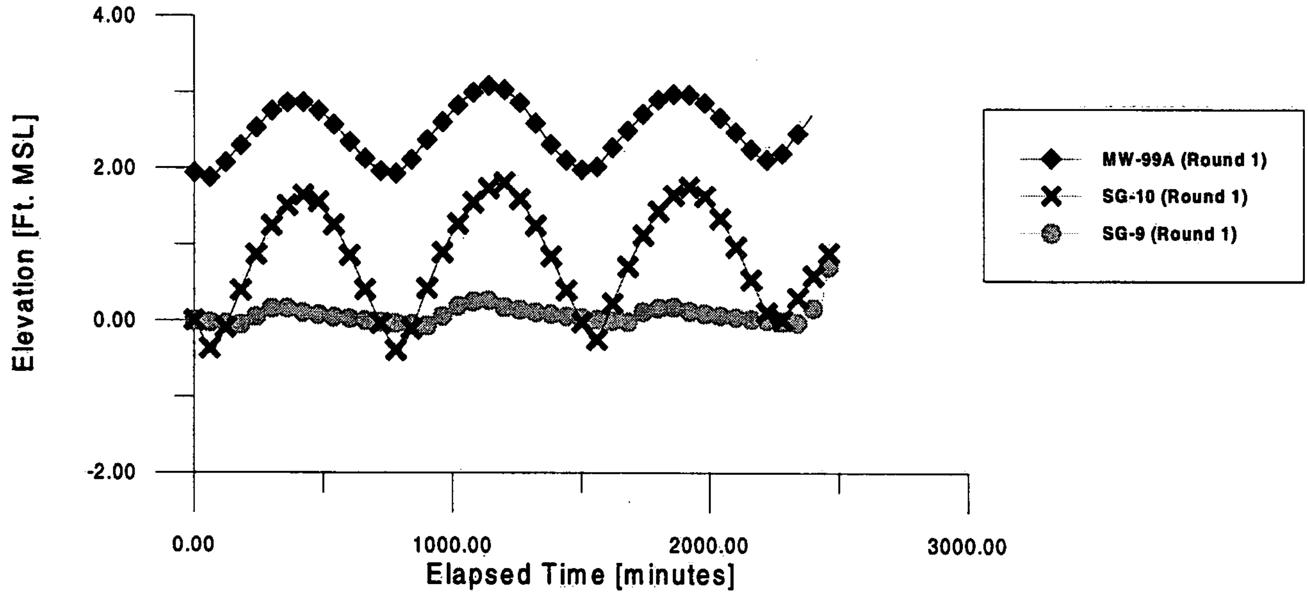
PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

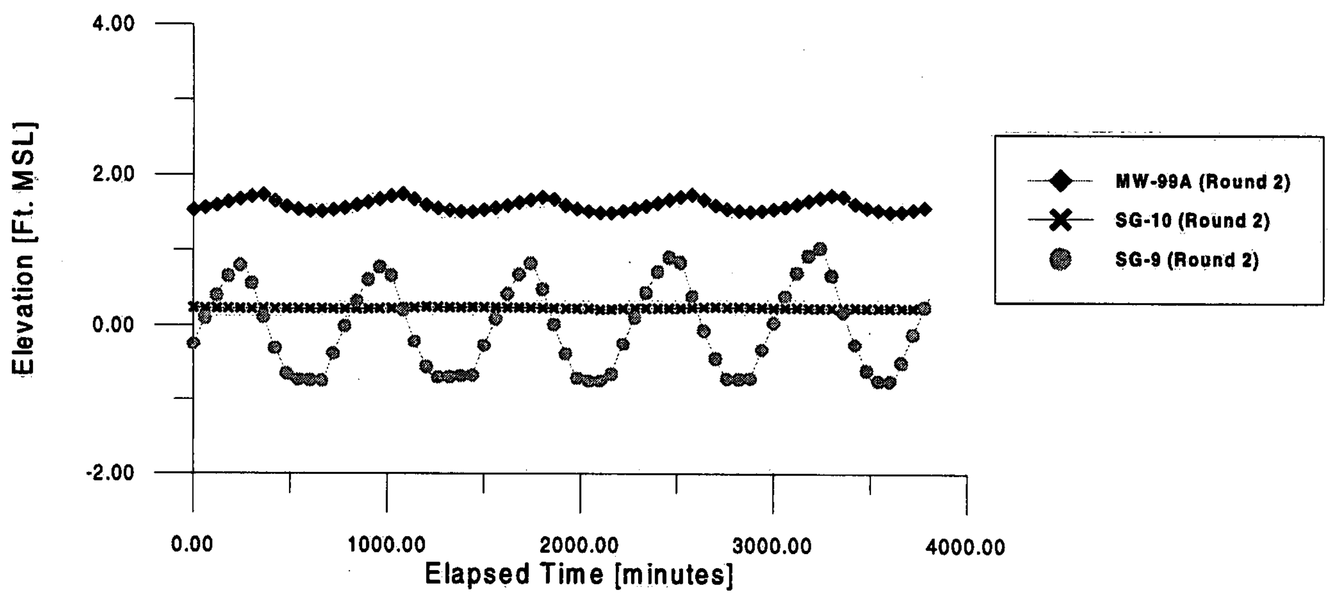
CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

ROUND 1 & 2 COMPARISON OF MW-90A TO SG-13 WATER LEVEL ELEVATIONS

DATE: JUNE 1995

FIGURE #: 4-27





W.O. #: 03886-062-010-0005 DATE: 6/16/95
FILE NAME: TBLOCKS.DWG DRAWN BY: B. MAC

WESTON
MANAGERS DESIGNERS/CONSULTANTS

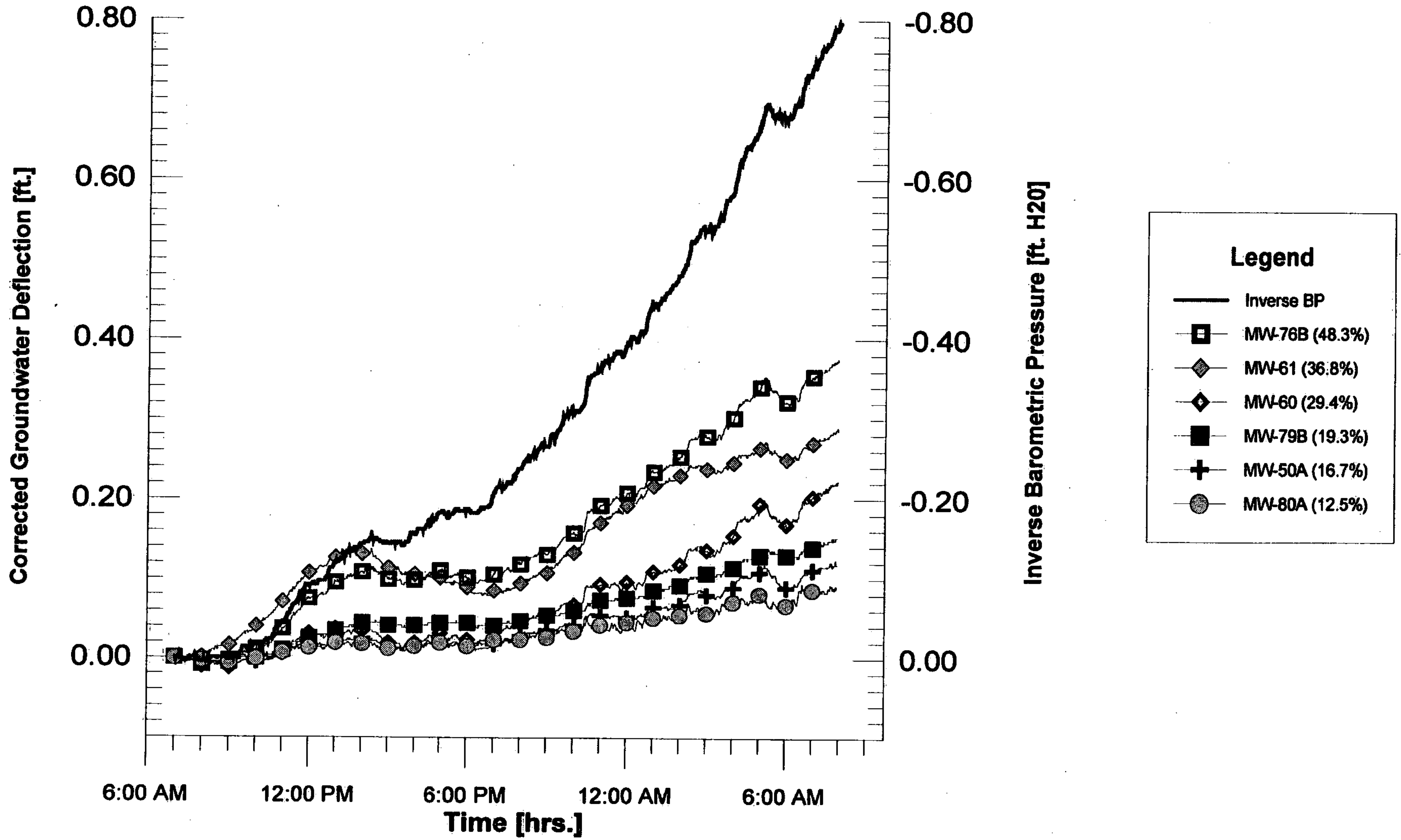
PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

ROUND 1 & 2 COMPARISON OF MW-99A TO SG-9 & SG-10 WATER LEVEL ELEVATIONS

DATE: JUNE 1995

FIGURE #: 4-28



WESTON
MANAGERS DESIGNERS/CONSULTANTS

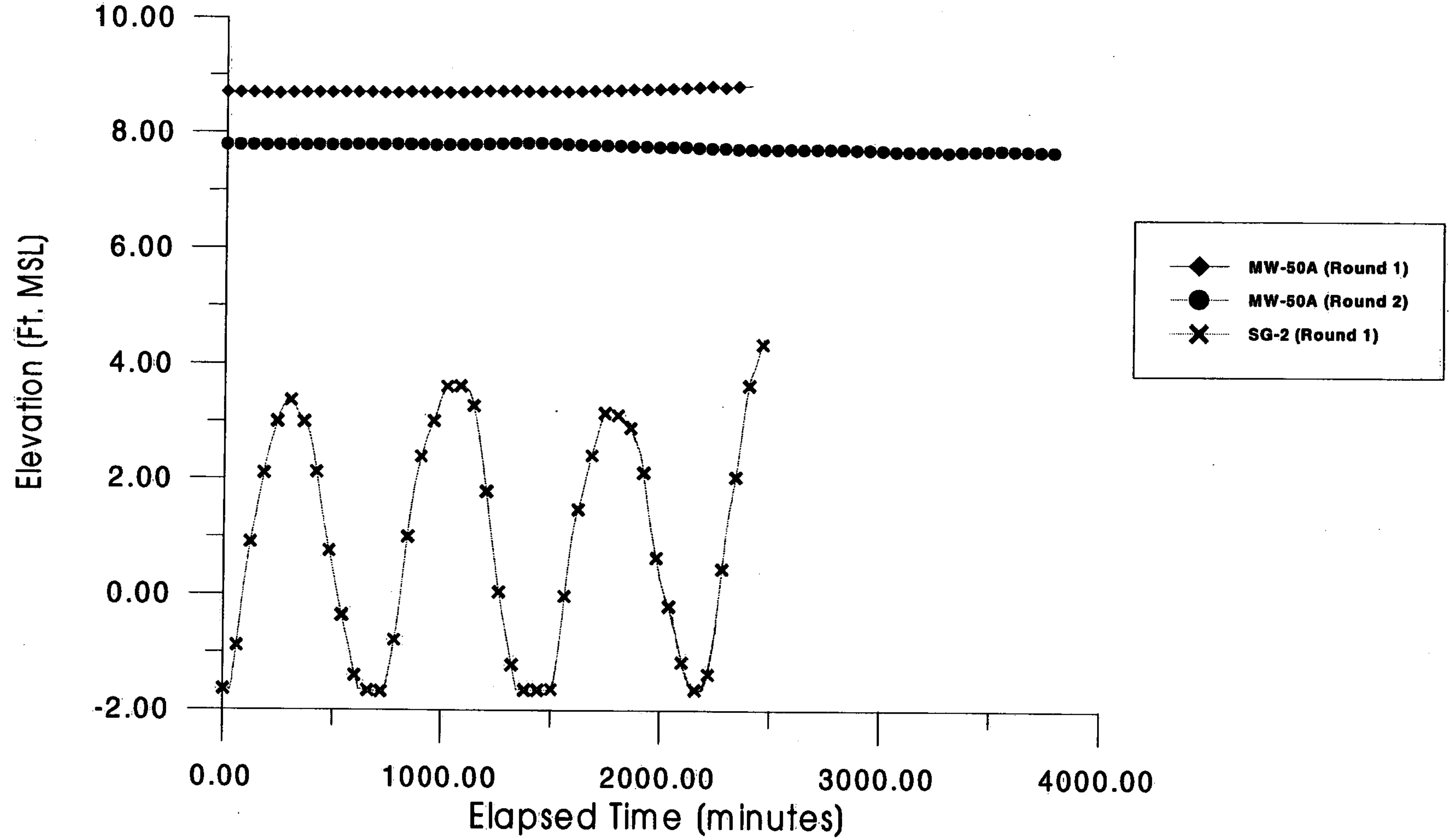
PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

NON-TIDALLY INFLUENCED MONITORING WELL RESPONSE TO BAROMETRIC PRESSURE

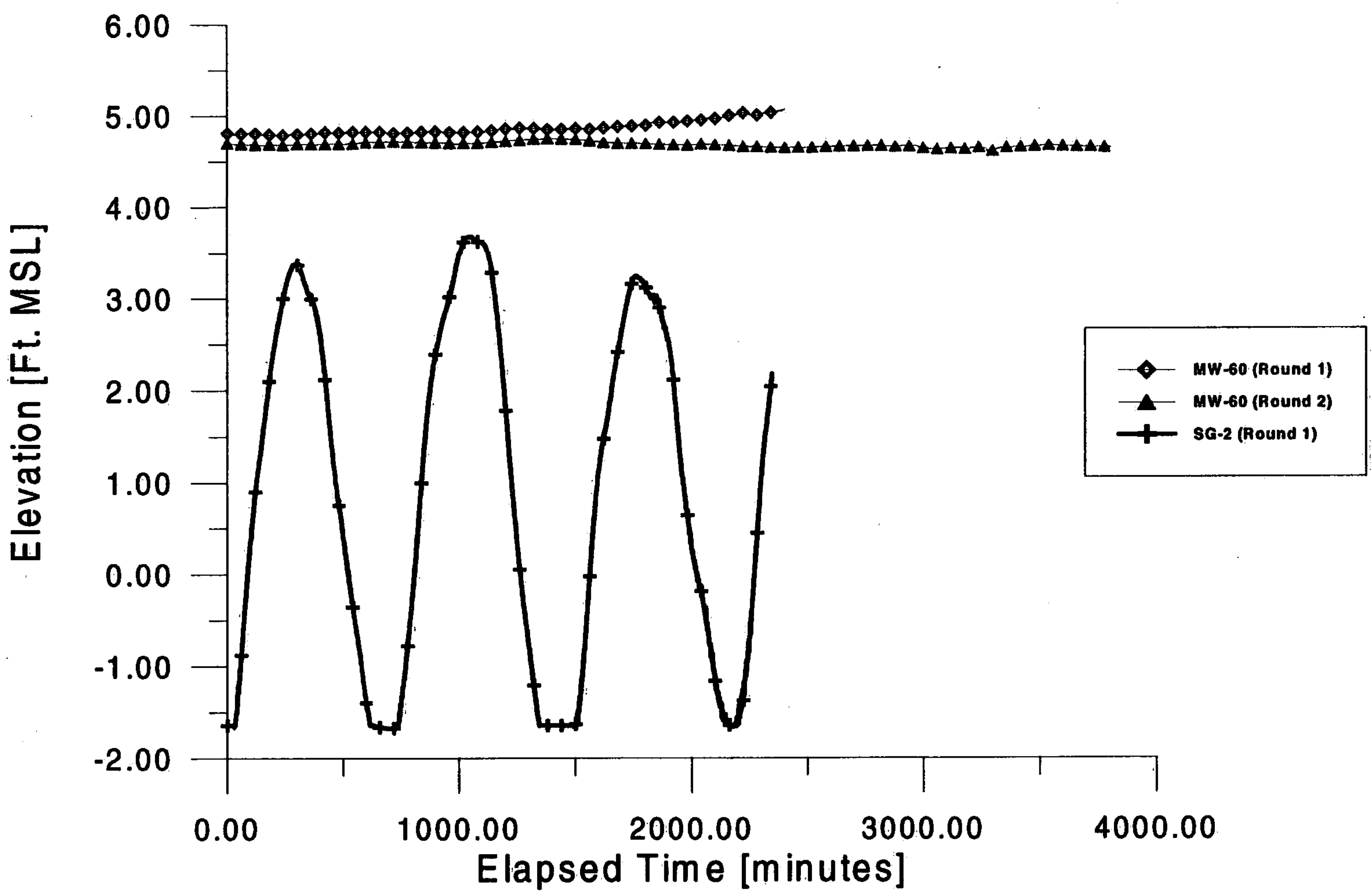
DATE: JUNE 1995

FIGURE #: 4-29



WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	ROUND 1 & 2 COMPARISON OF MW-50A TO SG-2 WATER LEVEL ELEVATIONS
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: JUNE 1995 FIGURE #: 4-30

REVISION #: 0000 DATE: 6/16/95 FILE NAME: TBLOCKS.DWG DRAWN BY: B. MAC



PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

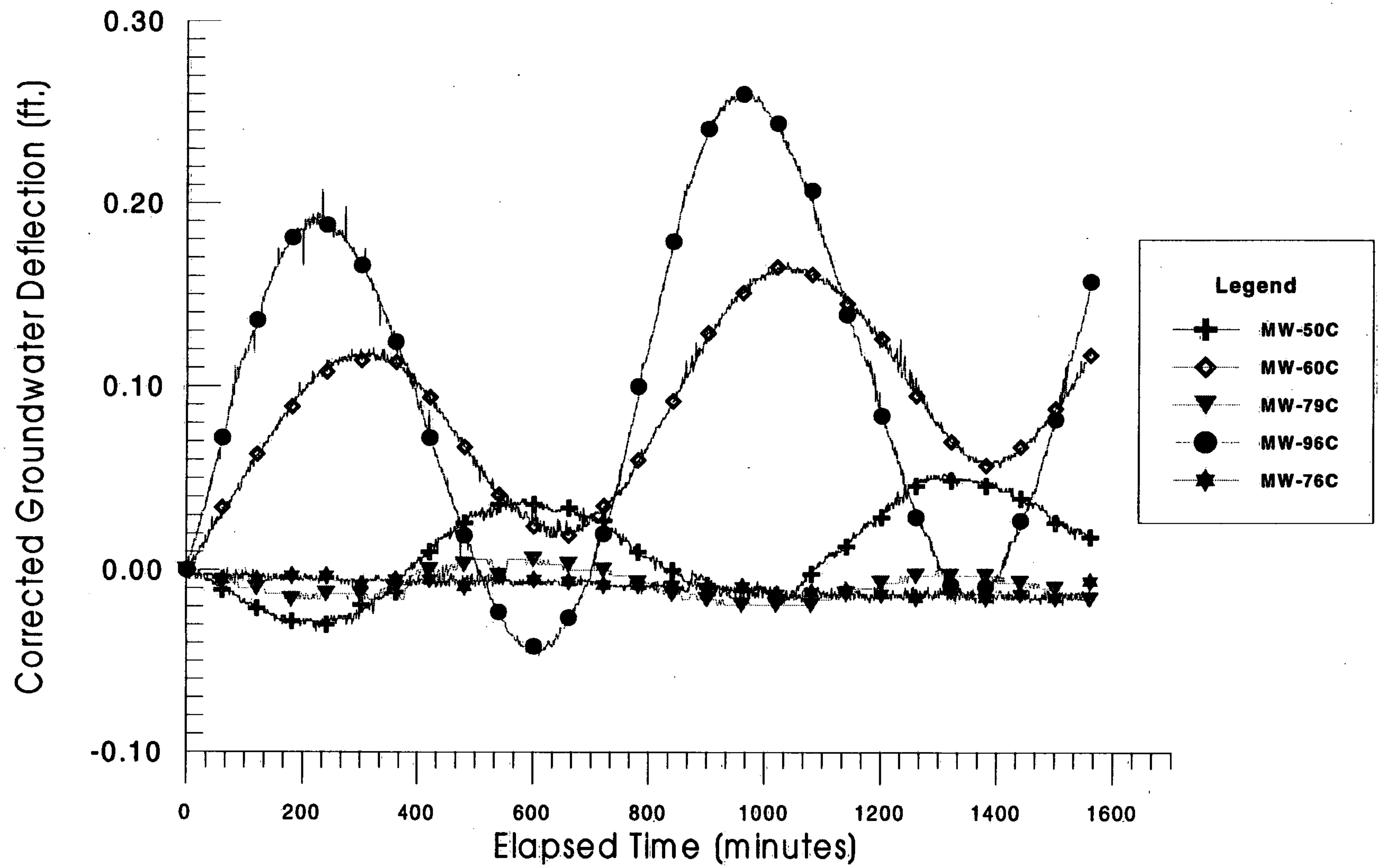
WESTON
MANAGERS DESIGNERS/CONSULTANTS

ROUND 1 & 2 COMPARISON
OF MW-60 TO SG-2
WATER LEVEL ELEVATIONS

DATE: JUNE 1995

FIGURE #: 4-31

REVISION #: 0000 DATE: 6/16/95
FILE NAME: TBLOCKS.DWG DRAWN BY: B. MAC



WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

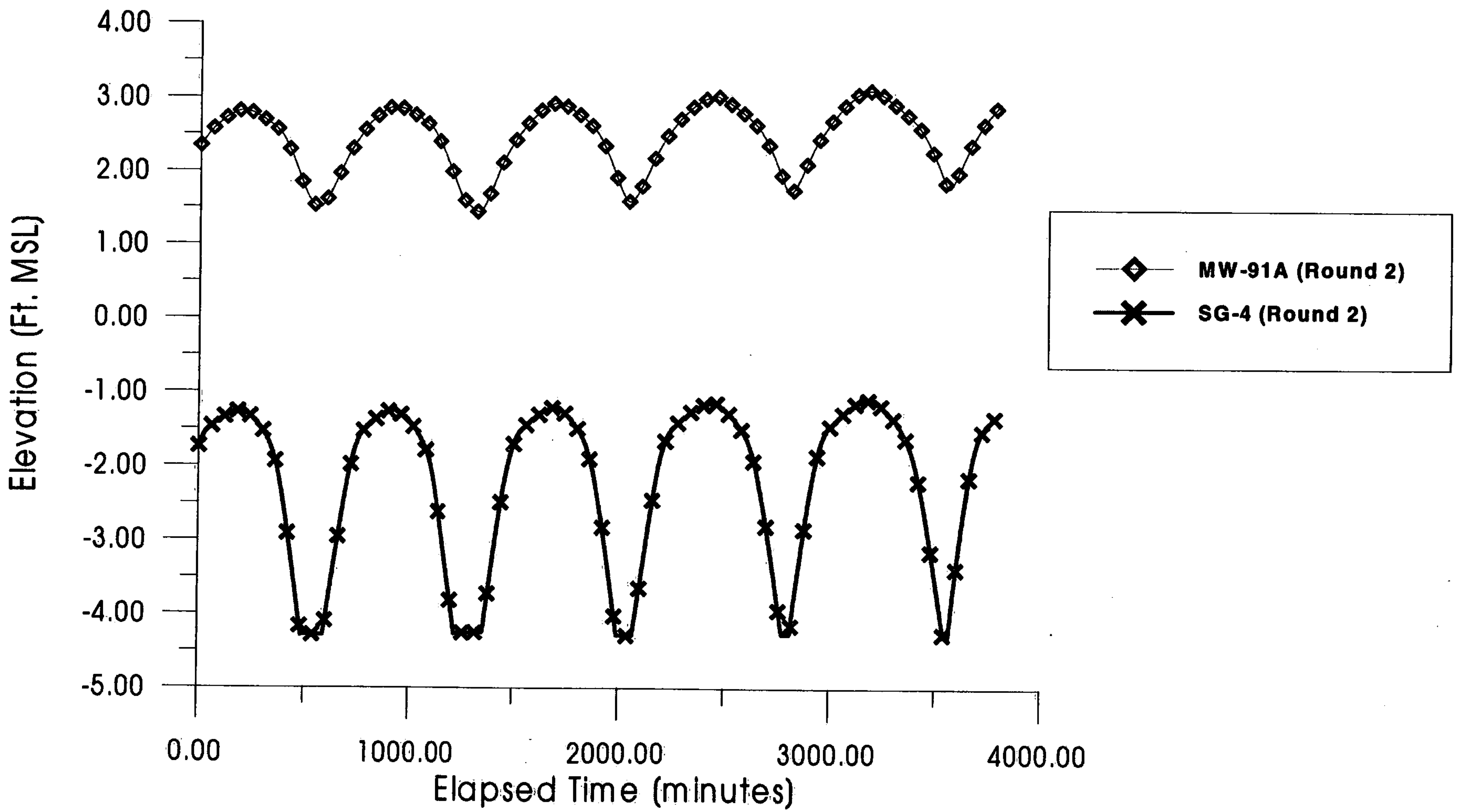
CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

ROUND 1 – MAGNITUDE OF TIDAL INFLUENCE ON BEDROCK MONITORING WELLS

DATE: JUNE 1995

FIGURE #: 4–32

REVISION #: 0000 DATE: 6/16/95 DRAWN BY: B. MAC
FILE NAME: TBLOCKS.DWG



WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

ROUND 2 COMPARISON
OF MW-91A TO SG-4
WATER LEVEL ELEVATIONS

DATE: JUNE 1995

FIGURE #: 4-33

REVISION #: 0000 DATE: 6/16/95 DRAWN BY: B. MAC
FILE NAME: TBLOCKS.DWG

AREAS OF CONCERN

AOC 1	OFF-SITE PLUME IN VICINITY OF RARITAN PLAZA I AND II
AOC 2	AREA 18C BUILDING 256
AOC 3	OWENS-ILLINOIS
AOC 4	THE POND AT AREA 18A
AOC 5	AREA 10 TENNIS COURT AREA
AOC 6	AREA 19
AOC 7	AREA 7
AOC OFF-SITE	NORTH OF EPA COMPLEX

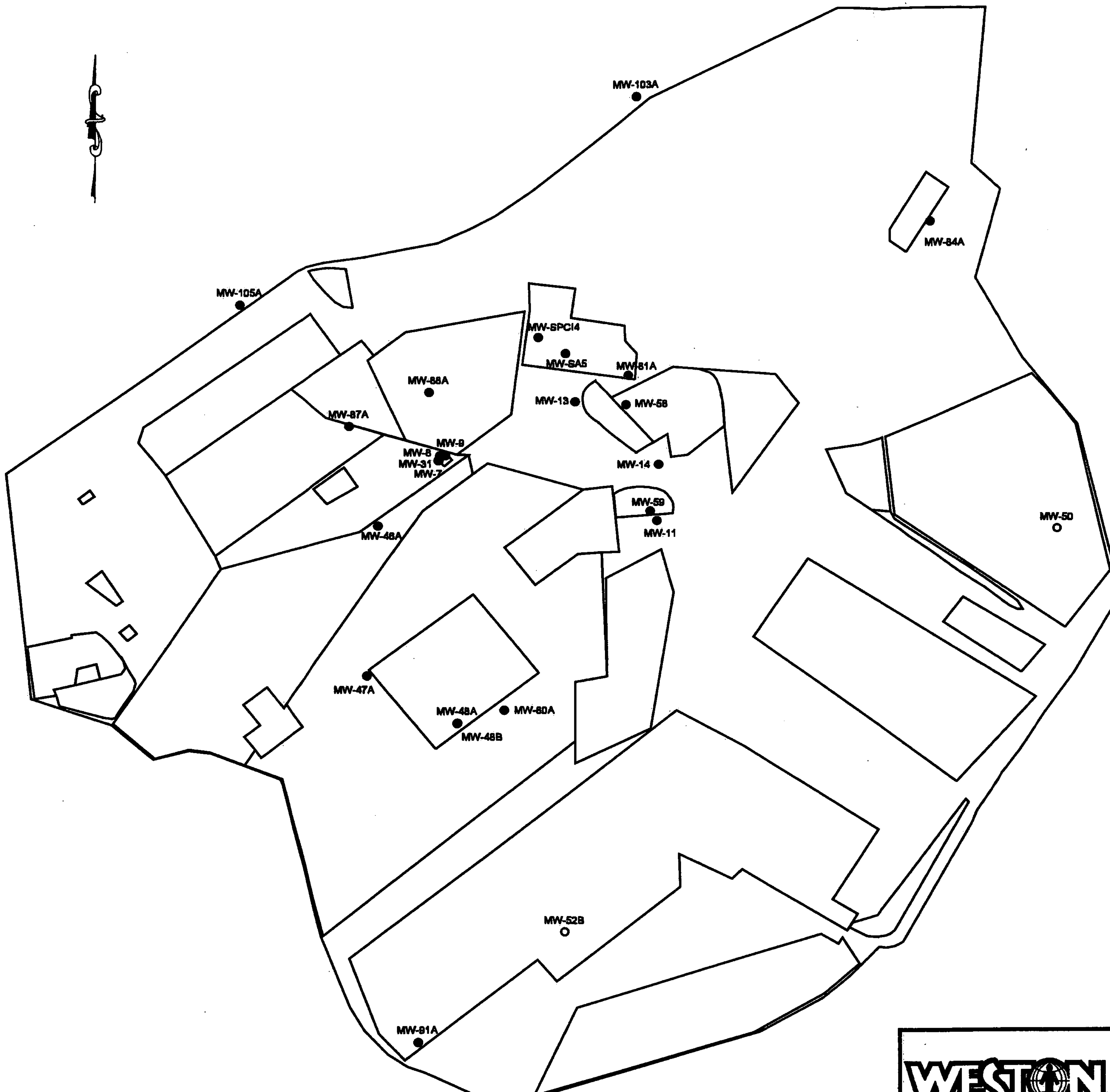
LEGEND

MW-50	MONITORING WELL LOCATION
	AREA BOUNDARIES
	BUILDINGS
	VOC GROUNDWATER CONTAMINATION
	SHALLOW GROUNDWATER SCREENING LOCATION
ND	NOT DETECTED
H	TOTAL HALOGENATED VOLATILE ORGANIC COMPOUNDS (ug/L)
A	TOTAL AROMATIC VOLATILE ORGANIC COMPOUDS (ug/L)

NOTES:

- SGWS WAS IMPLEMENTED USING THE GEOPROBE SYSTEM. THE SGWS PROGRAM WAS DESIGNED TO BE USED AS A GROUNDWATER CONTAMINATION SCREENING TOOL INCORPORATING RAPID TURNAROUND LABORATORY VOC ANALYSIS OF GROUNDWATER SAMPLES. A TOTAL OF 180 GEOPROBE ATTEMPTS WERE MADE AT 152 LOCATIONS. DUE TO VARIABLE LITHOLOGIC CONDITIONS (LOW-WATER YIELDING SILTS AND CLAYS), GROUNDWATER SAMPLES WERE SUCCESSFULLY COLLECTED AT ONLY 143 OF 152 LOCATIONS.
- ALL EXISTING AND NEWLY INSTALLED WELLS WERE SURVEYED DURING THE PHASE II RI INVESTIGATION BY GEOD CORPORATION.
- THIS SITE MAP HAS BEEN ADAPTED FROM A PHOTOGRAMMETRIC BASEMAP OF THE FORMER RARITAN ARSENAL PREPARED BY GEOD CORPORATION (12/22/92 OVERFLIGHT PHOTOGRAPHY) UNDER SUBCONTRACT TO WESTON.

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS		NOVEMBER 1994 VOC GROUNDWATER CONTAMINATION MAP
		CONTRACT No. DACA41-92-D-8002	DELIVERY ORDER No. 008	
		WORK ORDER No. 03886-082-010-0005	DATE: MAY 1996	REVISION No. 1 / FIGURE #: 5-1



- NOT TO SCALE -

Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	TRICHLOROETHYLENE (TCE) [UG/L]
MW-81A	151	590.00
MW-13	02	300.00
MW-SA5	151	240.00
MW-SPCI4	151	150.00
MW-58	03	110.00
MW-8	01	82.00
MW-31	01	48.00
MW-47A	09	30.00
MW-91A	16	28.00
MW-46A	10	27.00
MW-48B	09	24.00
MW-59	07	13.00
MW-80A	09	11.00
MW-80A (Dup)	09	11.00
MW-11	07	9.00
MW-84A	15	8.00
MW-48A	09	8.00
MW-87A	18D	7.00
MW-14	03	7.00
MW-103A	BKG	7.00
MW-7	01	5.00
MW-88A	18C	4.00
MW-105A	BKG	4.00
MW-9	01	2.00

Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	TRICHLOROETHYLENE (TCE) [UG/L]
None	None	None

Round 1 = ND

(ND = Not Detected, with the detection limit provided)

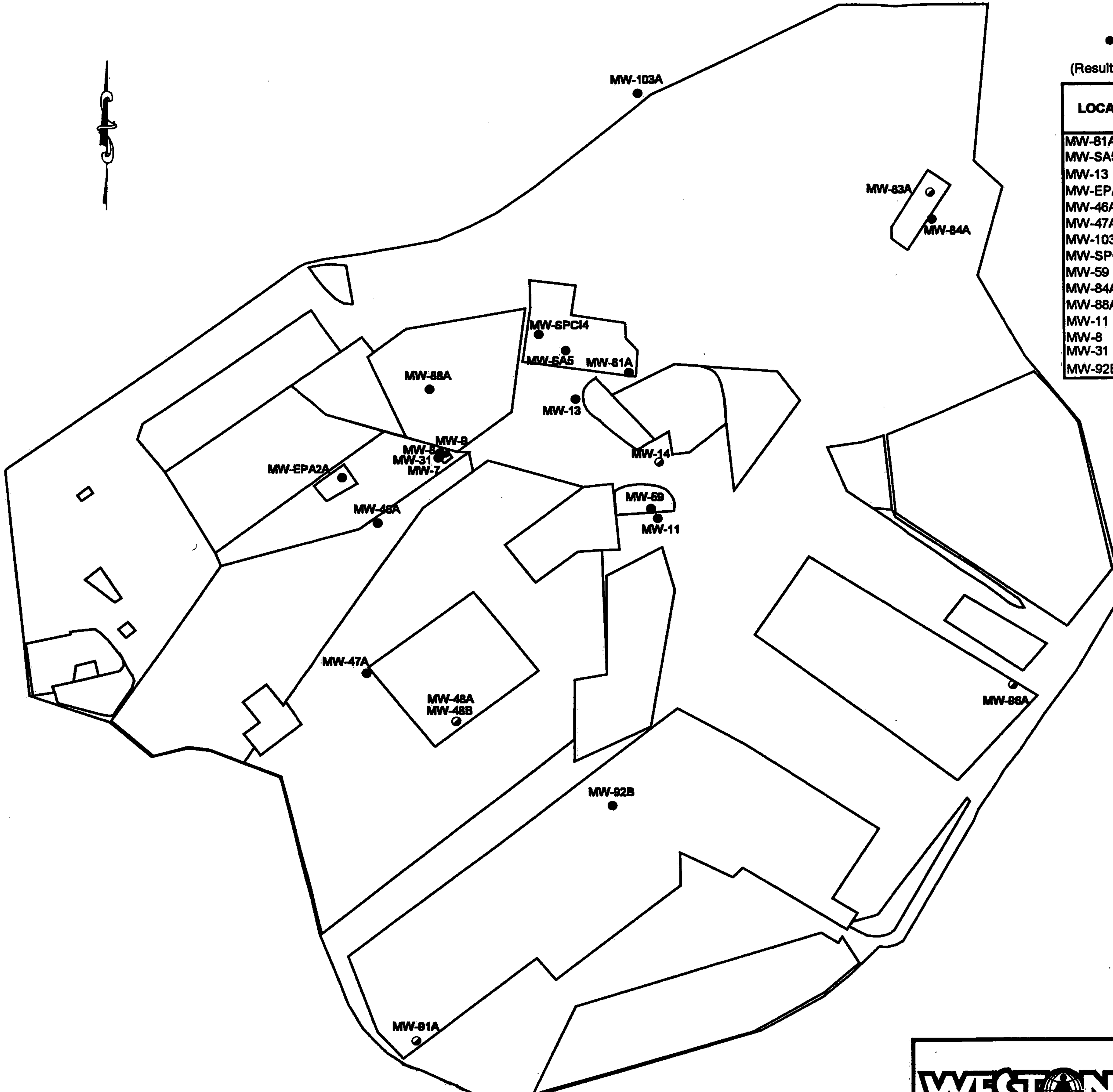
LOCATION	AREA	TRICHLOROETHYLENE (TCE) [UG/L]
MW-50	14	10.00 U
MW-52B	16	10.00 U

NOTES: THE NJDEP GWQS FOR TRICHLOROETHYLENE IS 1.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	ROUND 1 TRICHLOROETHYLENE (TCE) GROUNDWATER SAMPLING RESULTS
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: JUNE 1995 / FIGURE #: 5-2



- NOT TO SCALE -

● Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	1,2-DICHLOROETHENE [UG/L]
MW-81A	151	260.00
MW-SA5	151	220.00
MW-13	02	180.00
MW-EPA2A	18A	160.00
MW-46A	10	120.00
MW-47A	09	110.00
MW-103A	BKG	40.00
MW-SPCI4	151	36.00
MW-59	07	21.00
MW-84A	15	18.00
MW-88A	18C	17.00
MW-11	07	16.00
MW-8	01	14.00
MW-31	01	13.00
MW-92B	16	13.00

◐ Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	1,2-DICHLOROETHENE [UG/L]
MW-48A	09	9.00
MW-48B	09	6.00
MW-9	01	6.00
MW-7	01	3.00
MW-91A	16	3.00
MW-14	03	2.00
MW-83A	15	1.00
MW-96A	06	1.00

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	1,2-DICHLOROETHENE [UG/L]
MW-50	14	10.00 U
MW-52B	16	10.00 U

NOTES: THE NJDEP GWQS FOR TOTAL 1,2-DICHLOROETHENE IS 10.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON MANAGERS DESIGNERS/CONSULTANTS

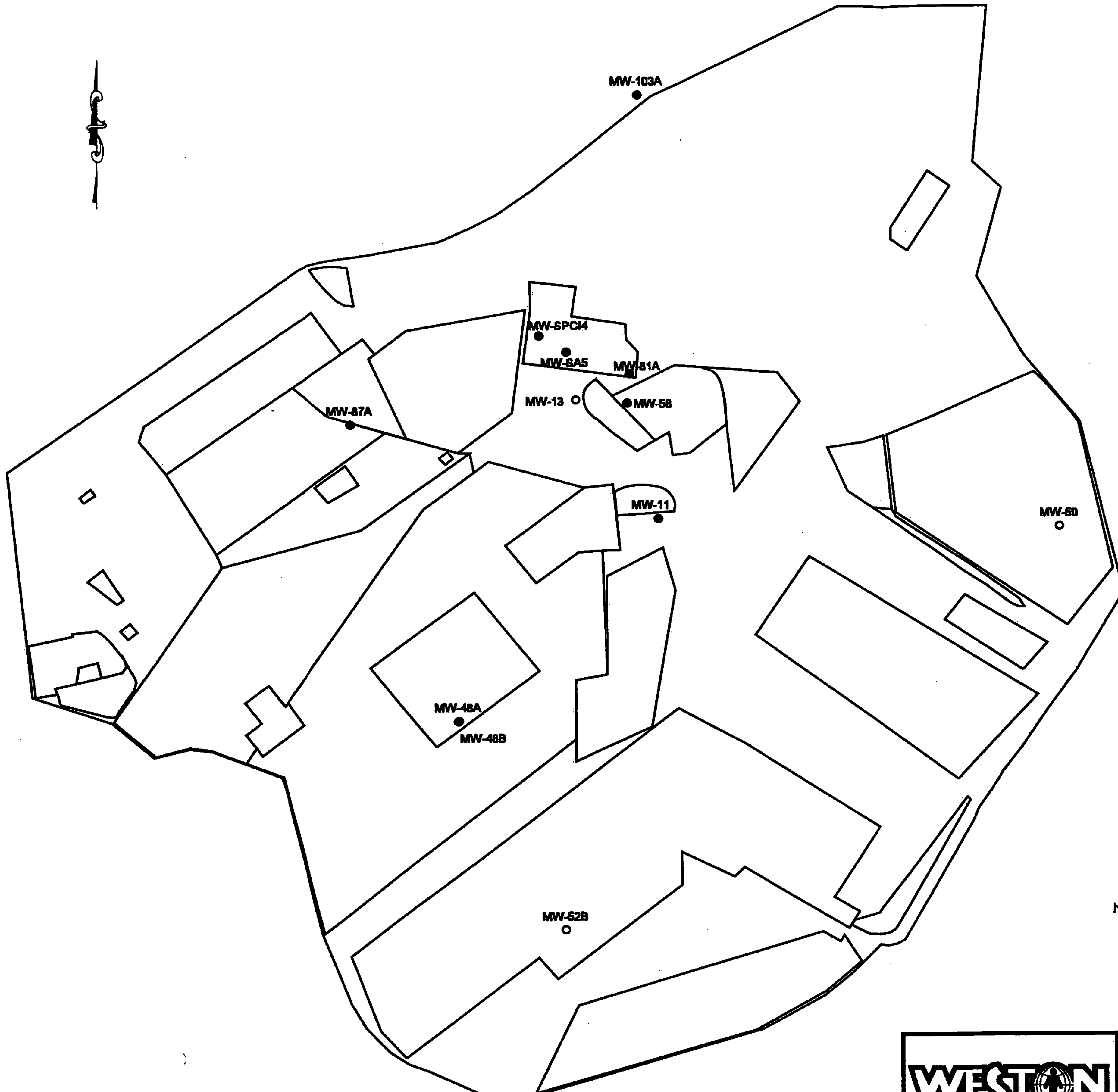
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1
TOTAL 1,2-DICHLOROETHENE
GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-3



- NOT TO SCALE -

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	TETRACHLOROETHYLENE(PCE) [UG/L]
MW-81A	151	31.00 J
MW-SPCI4	151	22.00
MW-SA5	151	22.00
MW-48A	09	16.00
MW-58	03	13.00
MW-103A	BKG	8.00
MW-48B	09	3.00
MW-11	07	3.00
MW-87A	18D	2.00

Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	TETRACHLOROETHYLENE(PCE) [UG/L]
None	None	None

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	TETRACHLOROETHYLENE(PCE) [UG/L]
MW-13	02	10.00 U
MW-50	14	10.00 U
MW-52B	16	10.00 U

NOTES: THE NJDEP GWQS FOR TETRACHLOROETHYLENE IS 1.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON MANAGERS DESIGNERS/CONSULTANTS

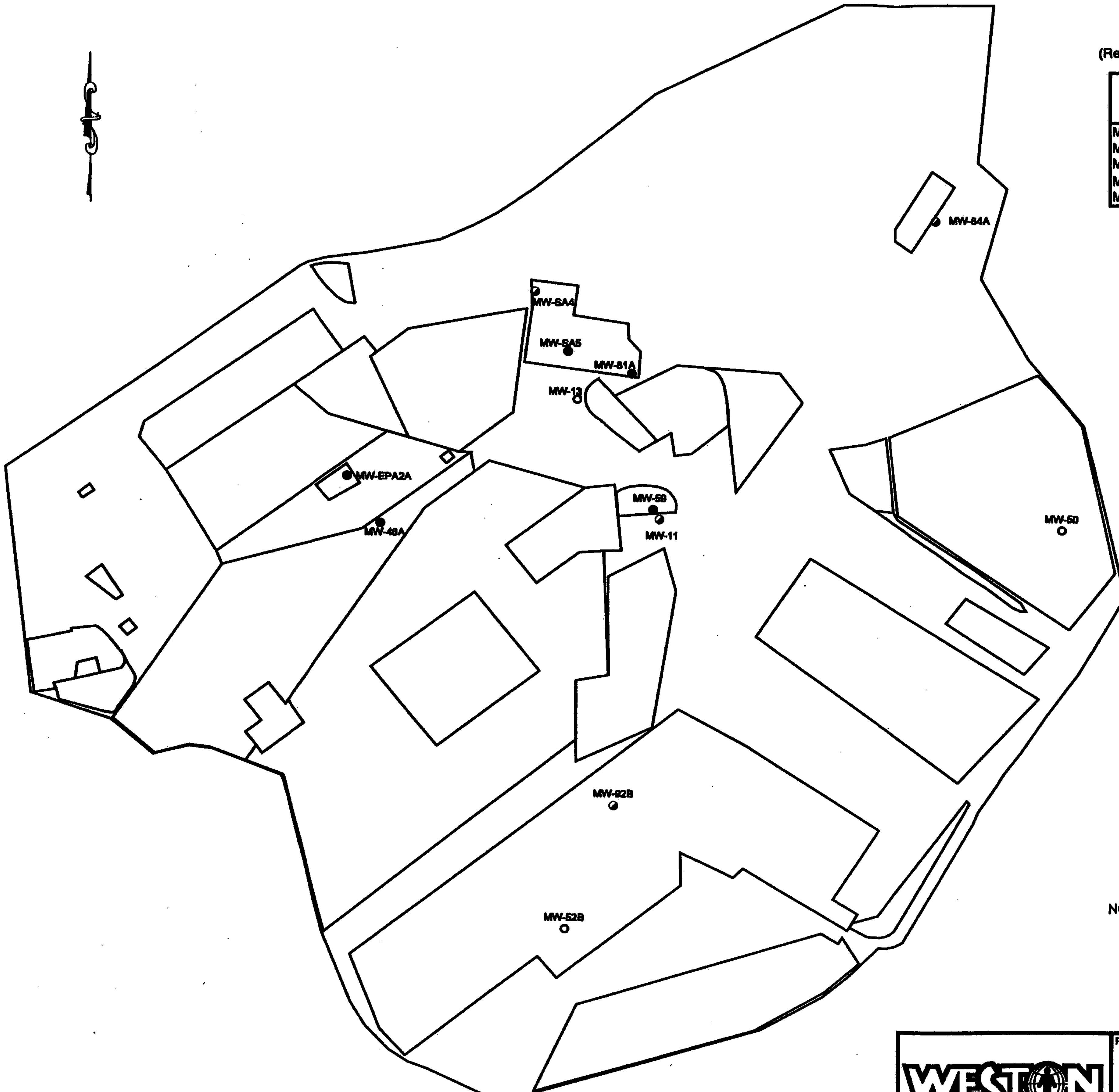
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1 TETRACHLOROETHYLENE (PCE) GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-4



• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	VINYL CHLORIDE [UG/L]
MW-EPA2A	18A	38.00
MW-SA5	151	16.00
MW-59	07	15.00
MW-46A	10	13.00
MW-81A	151	10.00 J

• Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	VINYL CHLORIDE [UG/L]
MW-11	07	4.00
MW-SA4	151	4.00
MW-92B	16	3.00
MW-84A	15	2.00

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	VINYL CHLORIDE [UG/L]
MW-13	02	20.00 U
MW-50	14	20.00 U
MW-52B	16	20.00 U

NOTES: THE NJDEP GWQS FOR VINYL CHLORIDE IS 5.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

– NOT TO SCALE –

WESTON MANAGERS DESIGNERS/CONSULTANTS

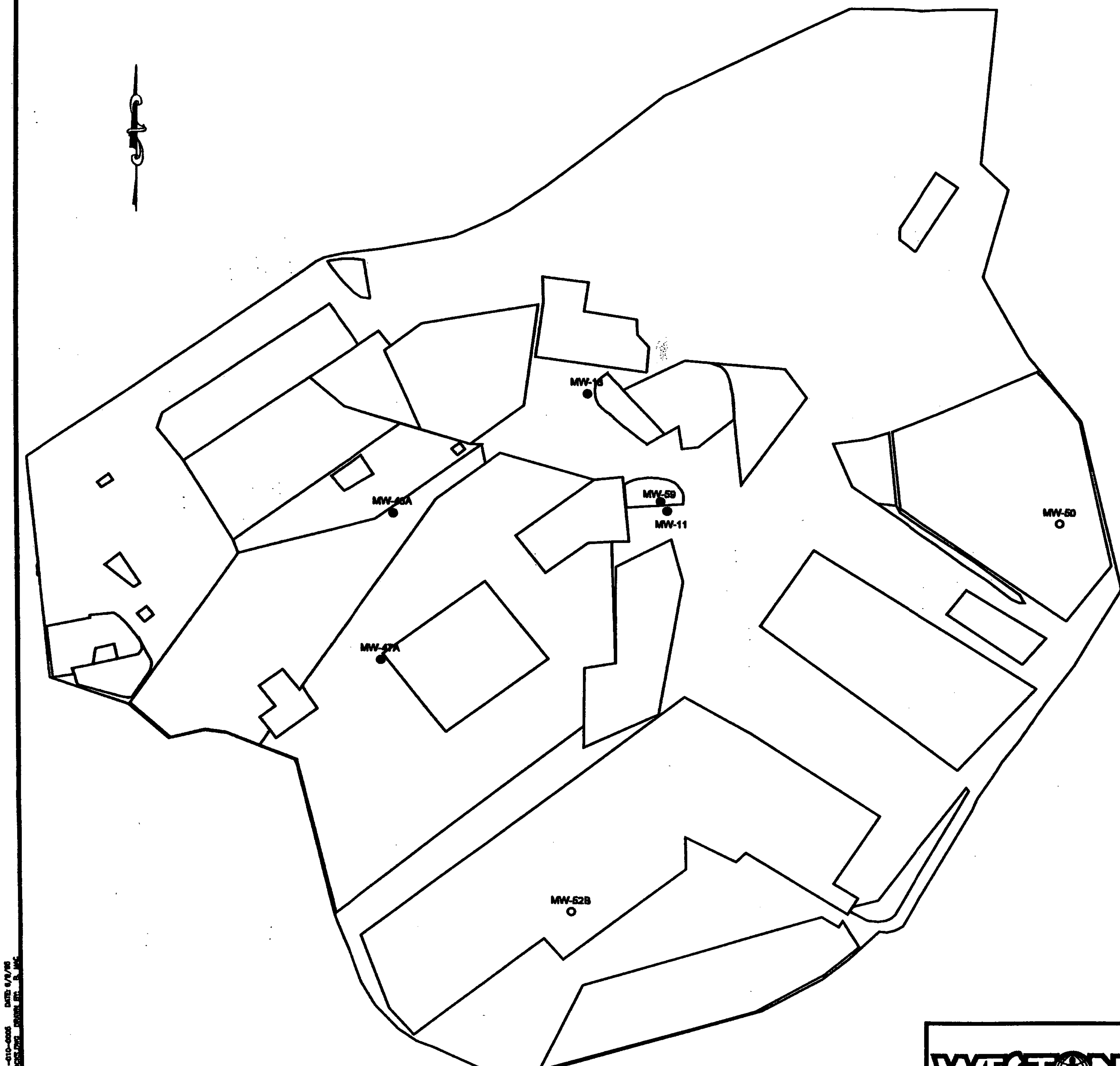
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1
VINYL CHLORIDE
GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-5



– NOT TO SCALE –

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	BENZENE [UG/L]
MW-13	02	72.00
MW-59	07	50.00
MW-47A	09	7.00
MW-11	07	4.00
MW-46A	10	1.80

Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	BENZENE [UG/L]
None	None	None

o Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	BENZENE [UG/L]
MW-50	14	10.00 U
MW-52B	16	10.00 U

NOTES: THE NJDEP GWQS FOR BENZENE IS 1.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

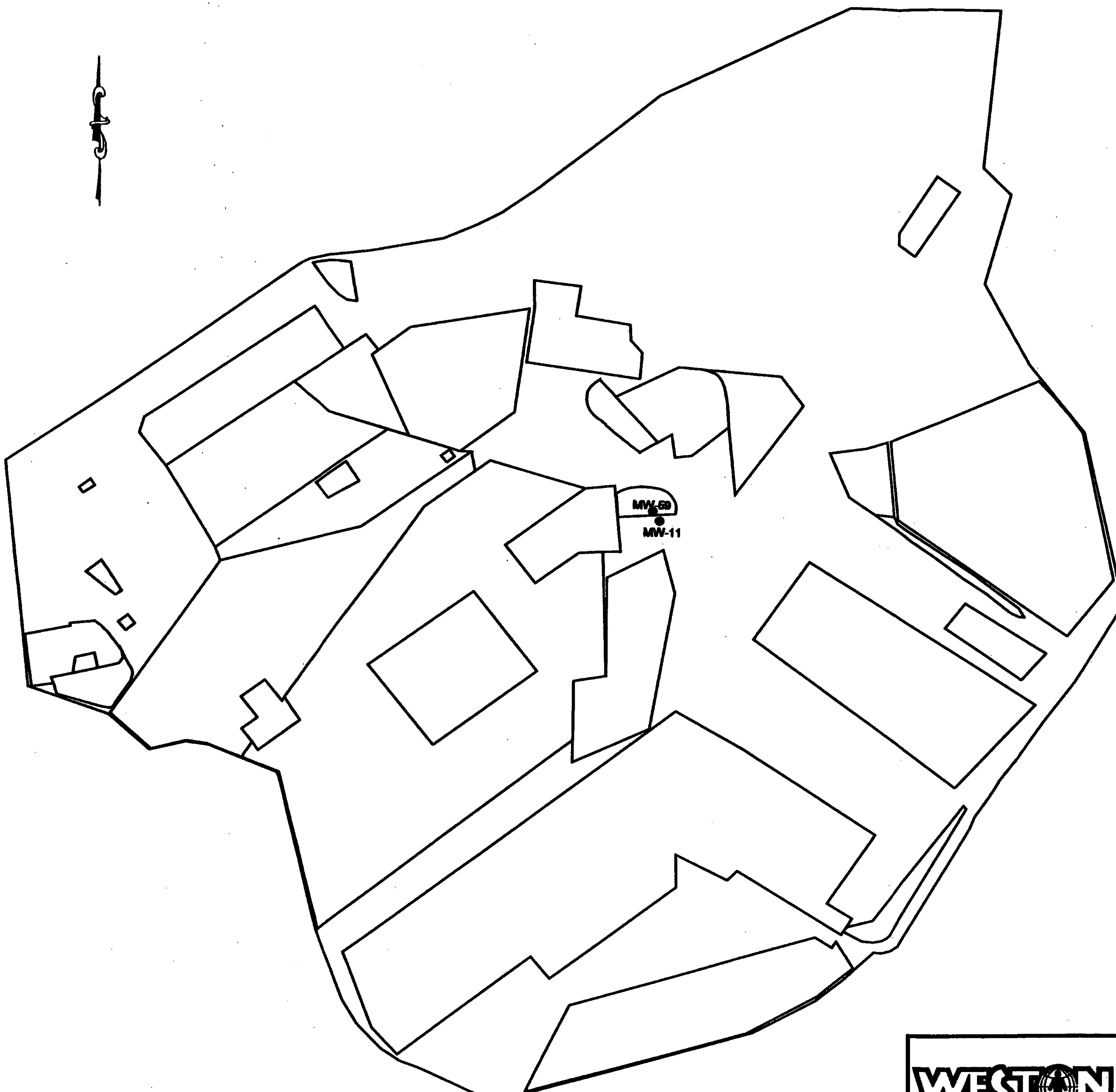
FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1
BENZENE
GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995
FIGURE #: 5-6



– NOT TO SCALE –

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	CHLOROBENZENE [UG/L]
MW-59	07	450.00
MW-11	07	82.00

• Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	CHLOROBENZENE [UG/L]
None	None	None

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	CHLOROBENZENE [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR CHLOROBENZENE IS 50.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

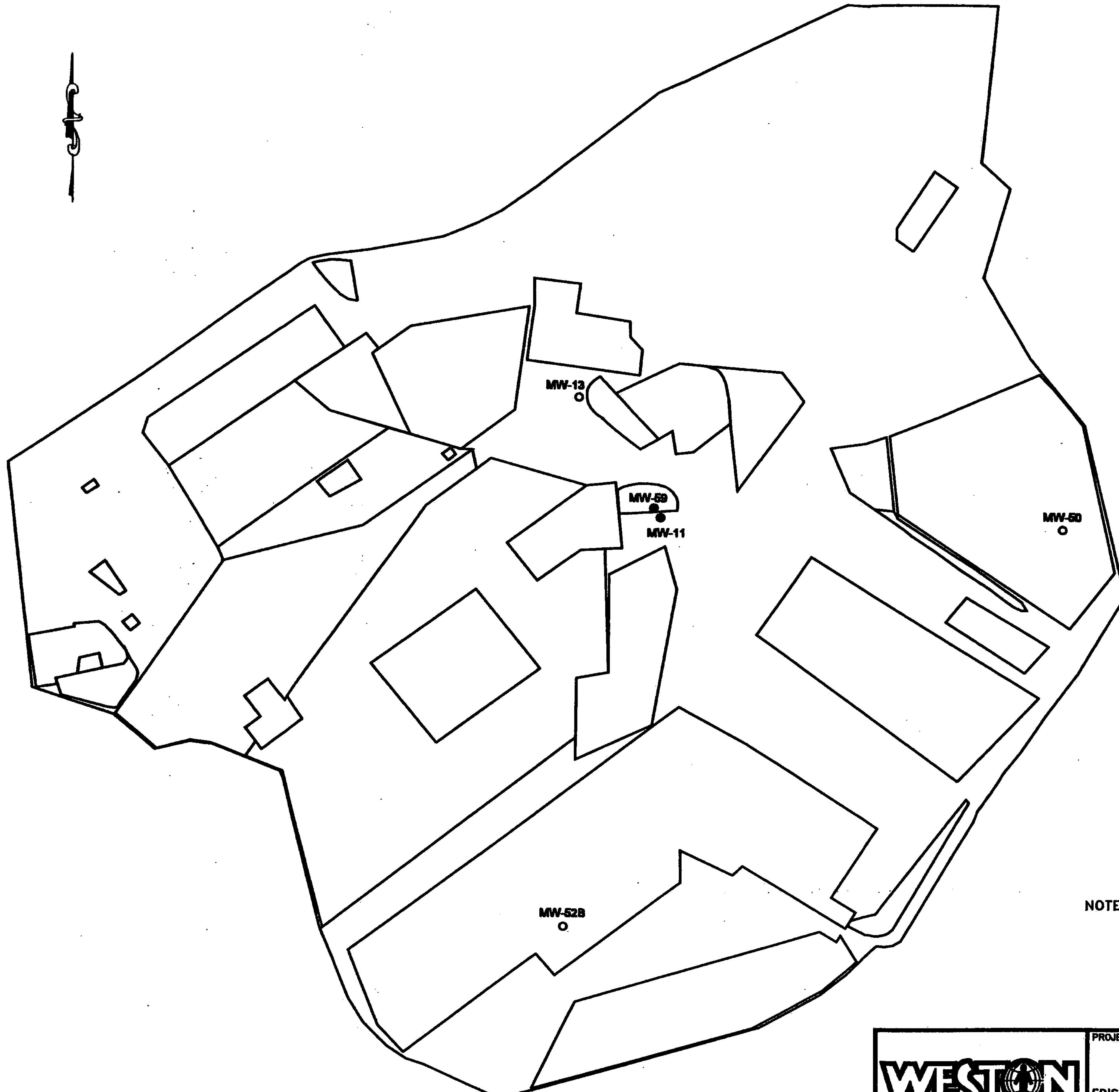
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1
CHLOROBENZENE
GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-7



- NOT TO SCALE -

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	1,2-DICHLOROETHANE [UG/L]
MW-59	07	16.00
MW-11	07	14.00

Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	1,2-DICHLOROETHANE [UG/L]
None	None	None

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	1,2-DICHLOROETHANE [UG/L]
MW-13	02	10.00 U
MW-50	14	10.00 U
MW-52B	16	10.00 U

NOTES: THE NJDEP GWQS FOR 1,2-DICHLOROETHANE IS 2.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

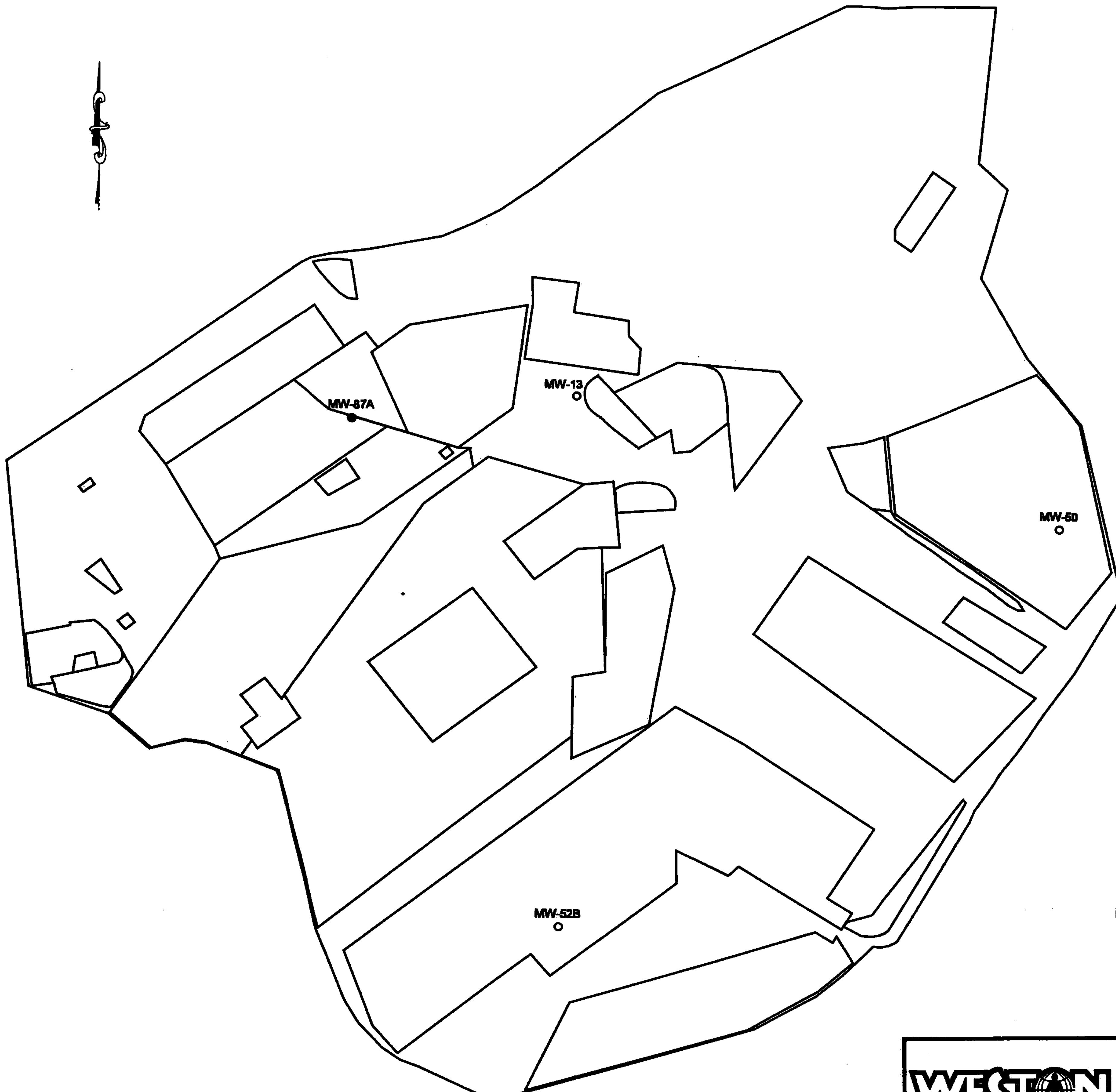
WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1
1,2-DICHLOROETHANE
GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-8



- NOT TO SCALE -

● Round 1 <= GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	DICHLOROBROMOMETHANE [UG/L]
MW-87A	18D	2.00

◉ Round 1 > GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	DICHLOROBROMOMETHANE [UG/L]
None	None	None

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	DICHLOROBROMOMETHANE [UG/L]
MW-13	02	10.00 U
MW-50	14	10.00 U
MW-52B	16	10.00 U

NOTES: THE NJDEP GWQS FOR DICHLOROBROMOMETHANE IS 1.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON MANAGERS DESIGNERS/CONSULTANTS

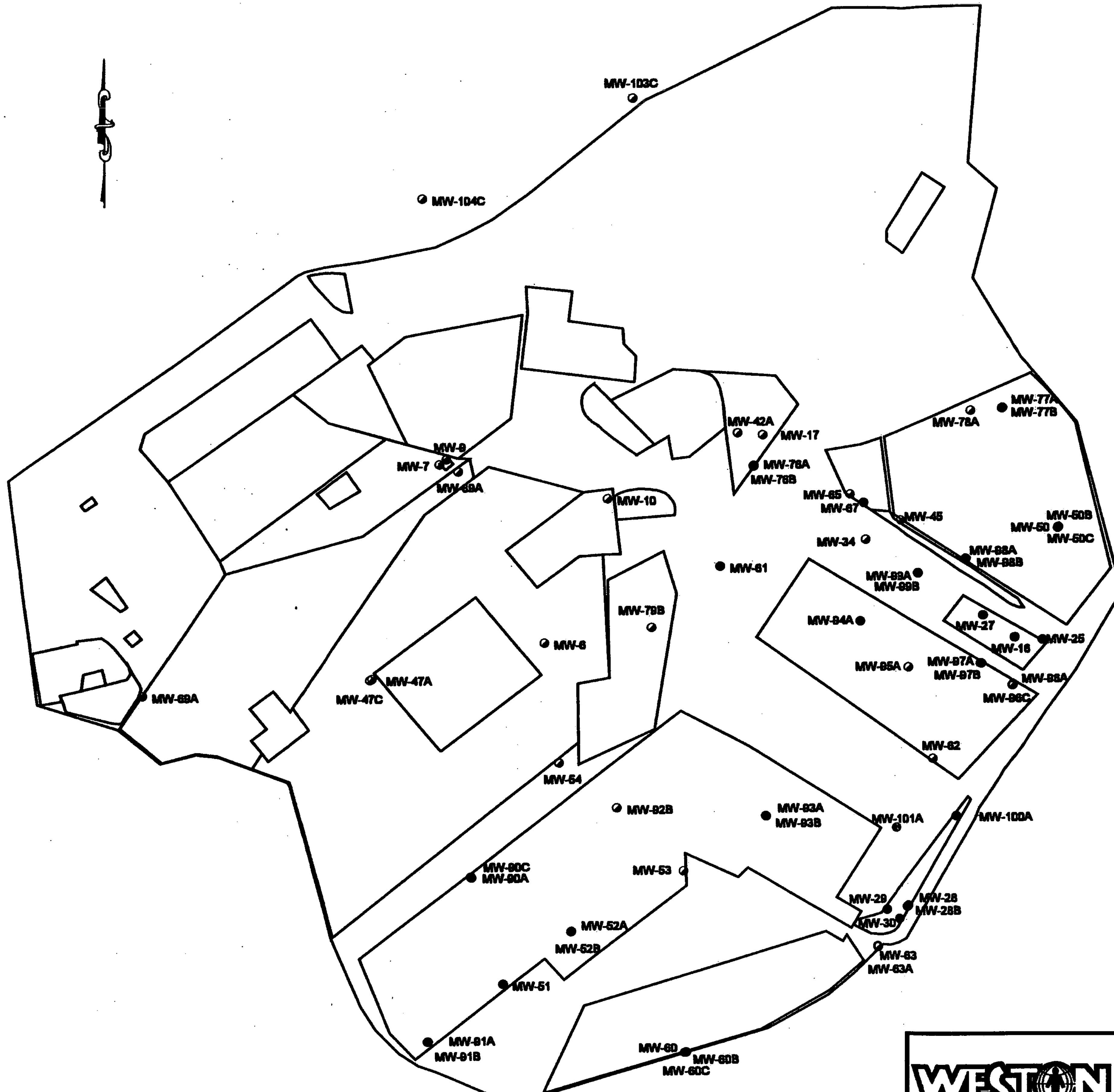
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1 DICHLOROBROMOMETHANE GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-9



– NOT TO SCALE –

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	ARSENIC [UG/L]
MW-50	14	398.00 J-
MW-30	11	78.00 J-
MW-29	11	66.40 J-
MW-28	11	29.20 J-
MW-99A	06B	28.60 J-
MW-100A	11	26.50 J
MW-51	16	21.50 J
MW-61	04	18.90
MW-67	05	17.10 J-
MW-77A	14	17.00
MW-101A	11	17.00 J
MW-27	06A	16.20 J-
MW-98A	06B	14.80 J-
MW-60B	12	13.80 J
MW-25	06A	12.80 J-
MW-90A	16	11.70 J
MW-94A	06	11.40
MW-91A	16	11.20 J-
MW-97A	06A	10.60 J-
MW-76B	04	9.70
MW-93B (Dup)	16	9.50 J-
MW-91B	16	9.50 J-
MW-52B	16	9.10 J-
MW-16	06A	8.20 J-

Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	ARSENIC [UG/L]
MW-47A	09	7.60
MW-77B	14	7.20
MW-54	19	6.60 J
MW-7	01	6.50
MW-96A	06	6.20
MW-42A	04	6.10 J
MW-92B	16	6.00 J
MW-50B	14	5.30 J-
MW-79B	08	5.20 J
MW-60	12	5.20 J
MW-104C	BKG	5.20
MW-53	16	4.90 J-
MW-6	19	4.80
MW-78A	14	4.70
MW-98B	06B	4.30 J-
MW-52A	16	4.30 J-
MW-17	04	4.30 J-
MW-76A	04	3.60
MW-95A	06	3.40
MW-69A	XHW	3.40
MW-45	14	3.10 J-
MW-103C	BKG	3.10
MW-65	05	3.00 J-
MW-10	20	2.70
MW-62	06	2.60
MW-47C	09	2.40
MW-89A	01	2.30 J-
MW-9	01	2.10
MW-90C	16	2.00
MW-63A	12	2.00 J-
MW-60C	12	2.00
MW-34	06B	1.80 J-

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	ARSENIC [UG/L]
MW-63	12	34.00 UJ
MW-99B	06B	8.50 UJ
MW-97B (Dup)	06A	8.50 U
MW-97B	06A	8.50 U
MW-96C	06	8.50 U
MW-93B	16	8.50 UJ
MW-93A	16	8.50 UJ
MW-50C	14	8.50 UJ
MW-28B	11	8.50 UJ

NOTES: THE NJDEP GWQS FOR ARSENIC IS 8.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

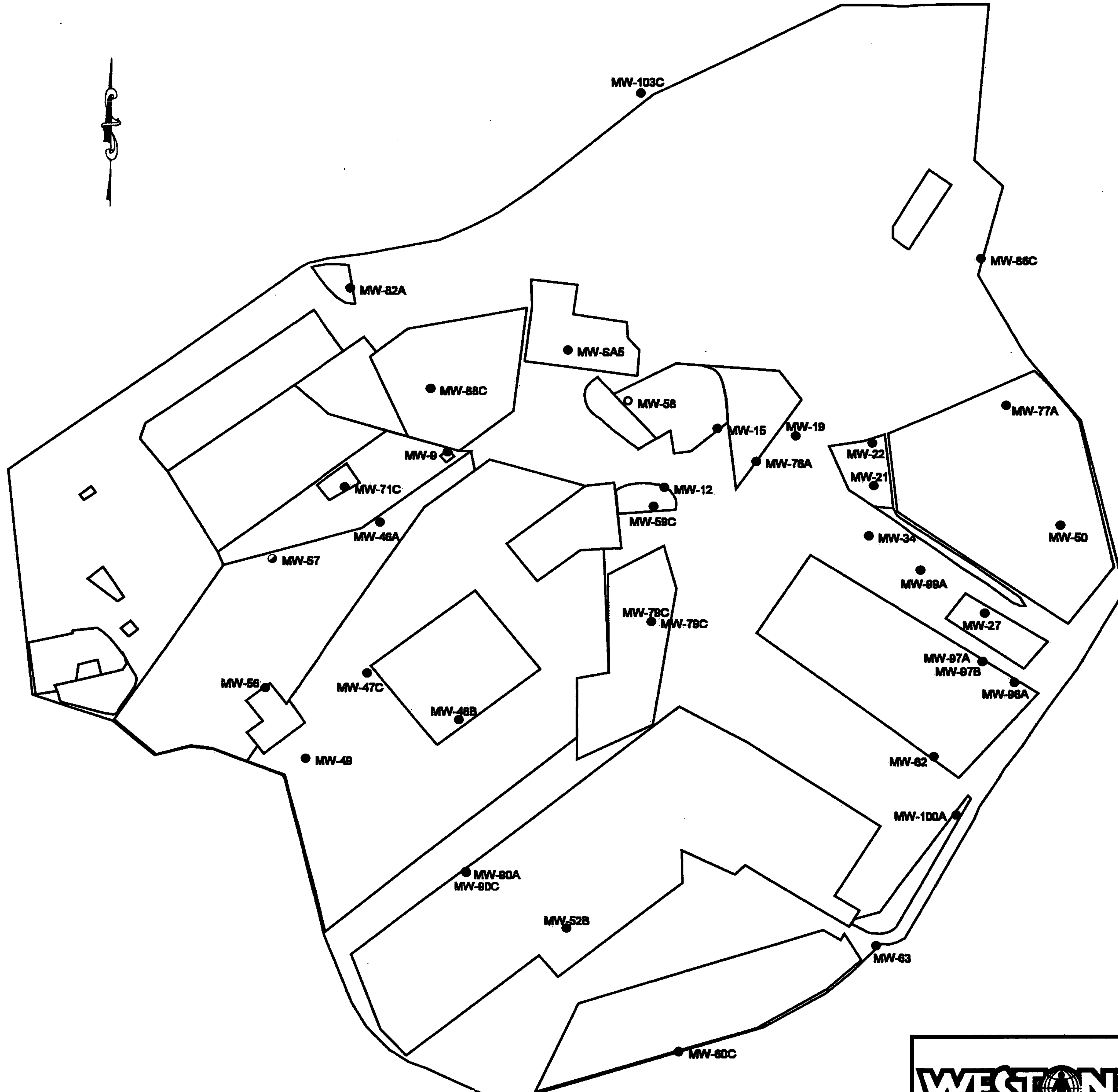
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1
ARSENIC GROUNDWATER
SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-10



- NOT TO SCALE -

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	IRON [UG/L]
MW-100A	11	159000
MW-27	06A	94800
MW-19	04	72300
MW-15	03	42500
MW-48B	09	40900
MW-63	12	37800
MW-76A	04	28500
MW-90A	16	27800
MW-77A	14	26300
MW-97A	06A	26300
MW-97B (Dup)	06A	26200
MW-97B	06A	25900
MW-SA5	151	20500
MW-50	14	18500
MW-22	05	12200
MW-99A	06B	11400
MW-52B	16	10400
MW-96A	06	8180
MW-90C	16	8040
MW-62	06	7370
MW-56	10	6410
MW-79C	08	5450
MW-47C	09	5060
MW-9	01	3560
MW-46A	10	3220
MW-12	07	2690
MW-49	19	2250
MW-71C	18A	2240
MW-21	05	1320
MW-86C	15	1270
MW-60C	12	1220
MW-34	06B	834
MW-103C	BKG	824
MW-88C	18C	609
MW-82A	OI	539
MW-59C	07	500
MW-59C (Dup)	07	478

• Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	IRON [UG/L]
MW-57	10	234

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	IRON [UG/L]
MW-58	03	311 U

NOTES: THE NJDEP GWQS FOR IRON IS 300 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

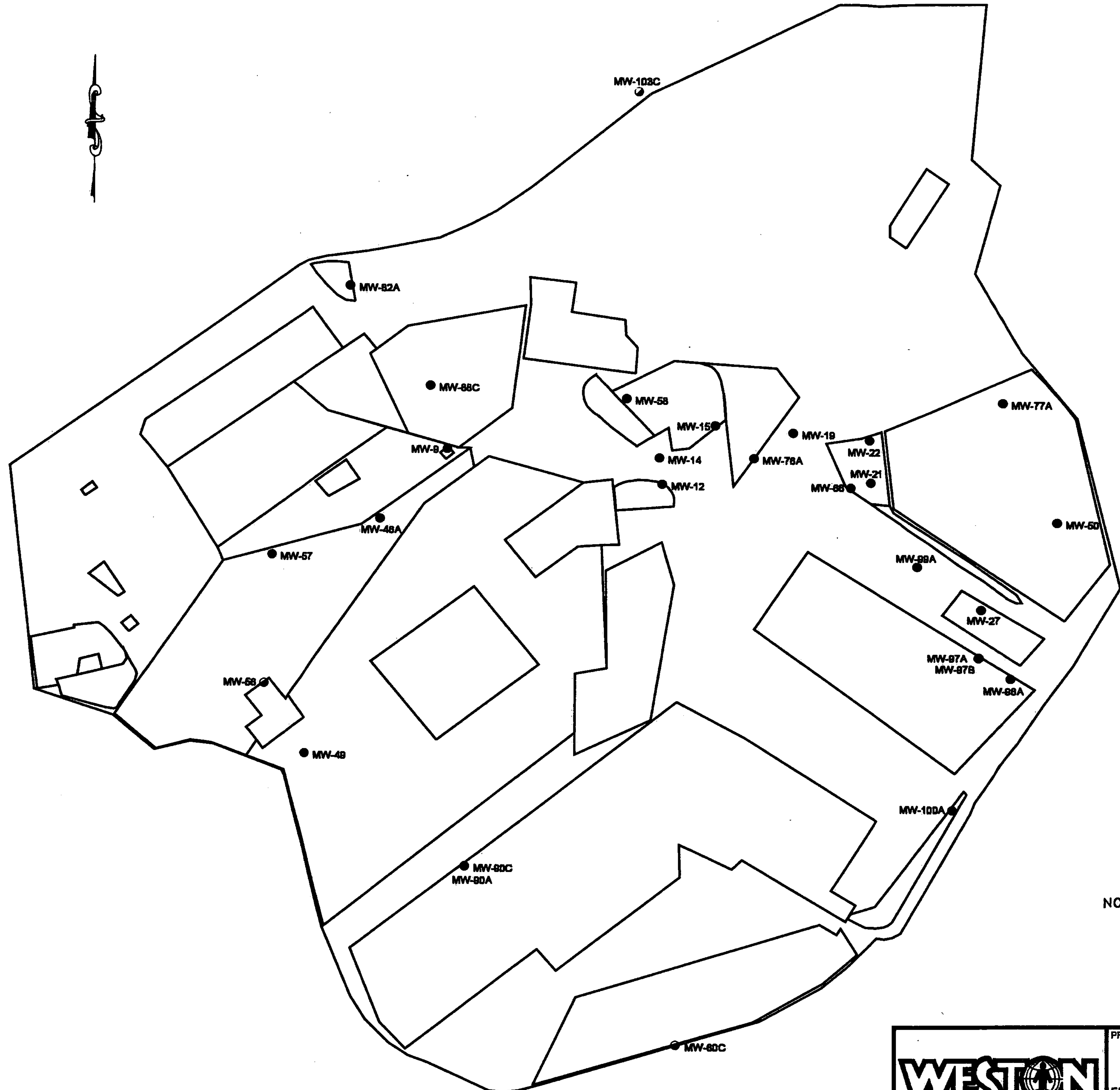
PROJECT NAME: FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1
IRON GROUNDWATER
SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-11



• **Round 1 > GWQS**

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	ALUMINUM [UG/L]
MW-100A	11	76900
MW-27	06A	5810
MW-97A	06A	4760
MW-57	10	4400 J
MW-76A	04	3950
MW-14	03	3480 J
MW-77A	14	2250
MW-58	03	2210
MW-46A	10	2060 J
MW-90C	16	2050
MW-12	07	1940
MW-49	19	1570 J
MW-96A	06	1370 J
MW-97B	06A	1290 J
MW-97B (Dup)	06A	934 J
MW-22	05	825
MW-50	14	667
MW-9	01	630 J
MW-99A	06B	573
MW-82A	OI	414
MW-19	04	386 J
MW-66	05	386
MW-15	03	253
MW-88C	18C	240
MW-21	05	214 J

• **Round 1 <= GWQS**

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	ALUMINUM [UG/L]
MW-60C	12	132
MW-56	10	119 J
MW-103C	BKG	33.9

○ **Round 1 = ND**

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	ALUMINUM [UG/L]
MW-90A	16	405 U

NOTES: THE NJDEP GWQS FOR ALUMINUM IS 200 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

– NOT TO SCALE –

WESTON
MANAGERS DESIGNERS/CONSULTANTS

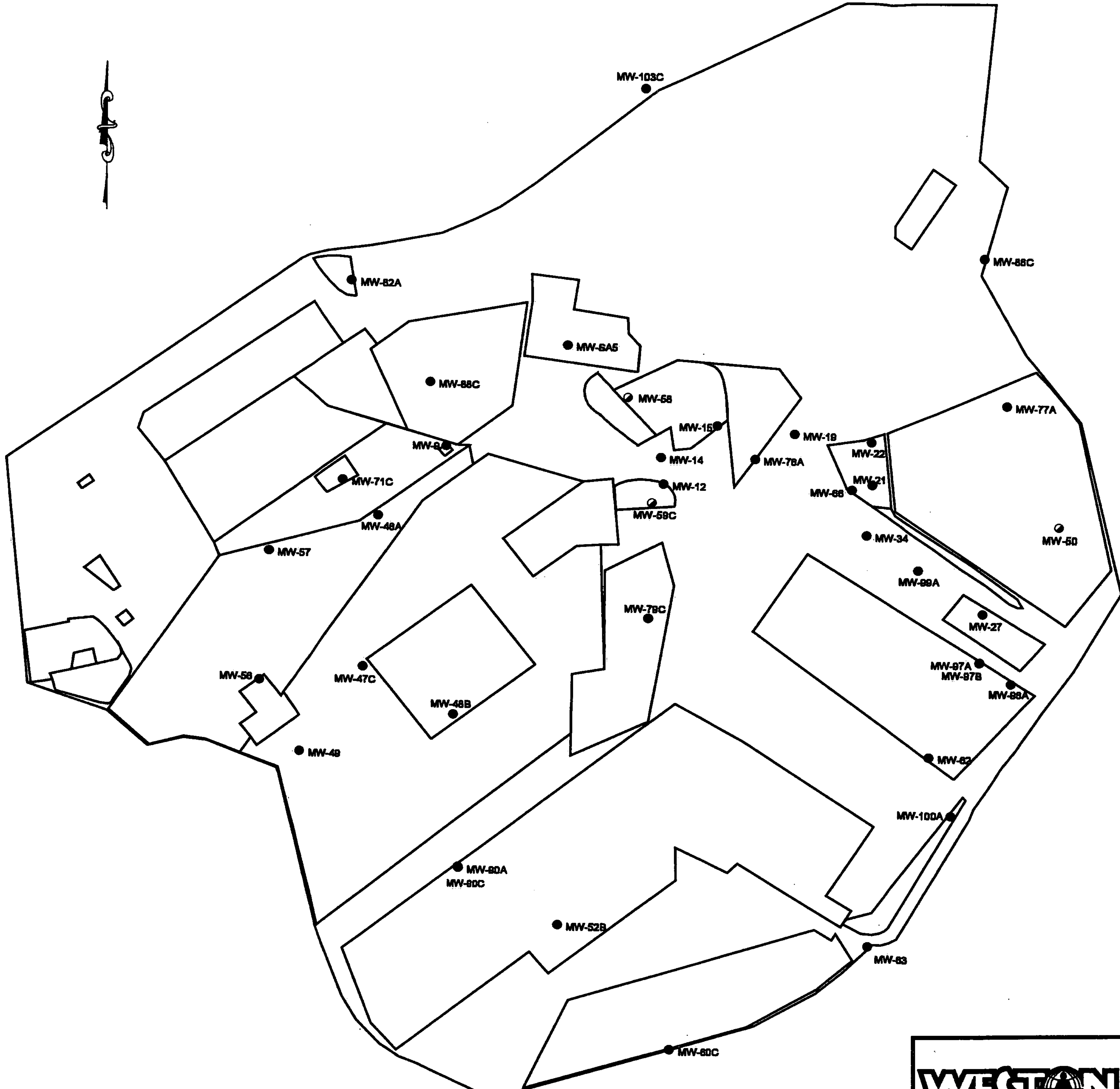
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1 ALUMINUM GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-12



– NOT TO SCALE –

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	MANGANESE [UG/L]
MW-62	06	8000
MW-90C	16	5000
MW-19	04	2330
MW-100A	11	2270
MW-15	03	1990
MW-79C	08	1690
MW-21	05	1670
MW-66	05	1420
MW-77A	14	1050
MW-27	06A	1040
MW-90A	16	944
MW-22	05	740
MW-76A	04	694
MW-48B	09	666
MW-97B	06A	644
MW-34	06B	639
MW-97B (Dup)	06A	611
MW-97A	06A	465
MW-96A	06	411
MW-99A	06B	265
MW-47C	09	230
MW-63	12	199
MW-49	19	172
MW-56	10	161
MW-57	10	160
MW-71C	18A	129
MW-60C	12	122
MW-82A	OI	120
MW-12	07	113
MW-SA5	151	100
MW-9	01	94.4
MW-52B	16	84
MW-14	03	83.9
MW-46A	10	72.1
MW-88C	18C	66.5
MW-86C	15	63.2
MW-103C	BKG	55

Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	MANGANESE [UG/L]
MW-50	14	49.9
MW-58	03	49.3
MW-59C	07	48.9
MW-59C (Dup)	07	46.5

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	MANGANESE [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR MANGANESE IS 50.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

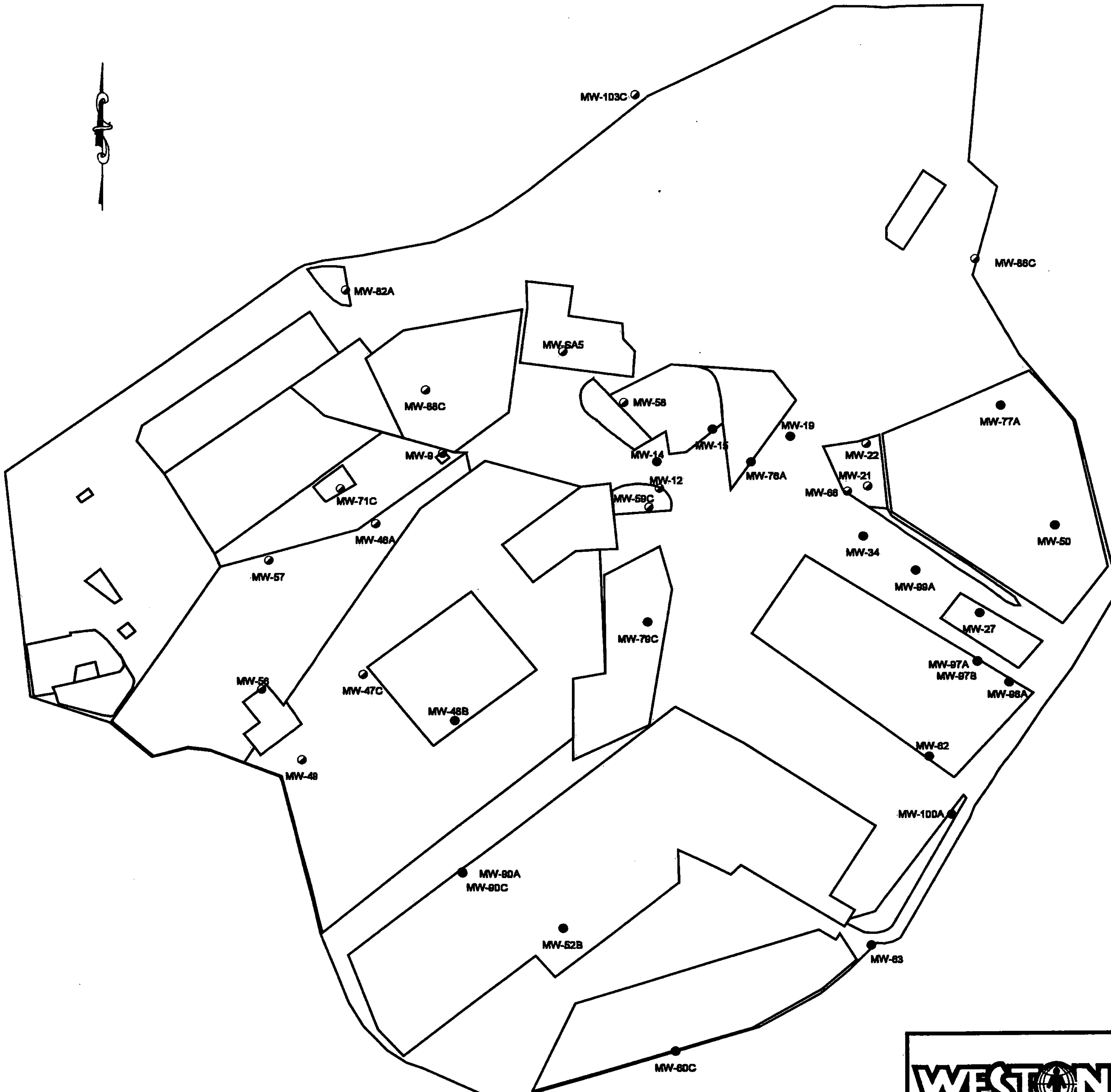
PROJECT NAME: FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1
MANGANESE GROUNDWATER
SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-13



- NOT TO SCALE -

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	SODIUM [UG/L]
MW-62	06	5770000.00
MW-63	12	5140000.00
MW-97B (Dup)	06A	3810000.00
MW-97B	06A	3800000.00
MW-60C	12	3530000.00
MW-97A	06A	3400000.00
MW-52B	16	2790000.00
MW-90C	16	2320000.00
MW-90A	16	2030000.00
MW-96A	06	1830000.00
MW-99A	06B	1440000.00
MW-100A	11	767000.00
MW-50	14	358000.00
MW-77A	14	326000.00
MW-34	06B	261000.00
MW-19	04	227000.00
MW-14	03	145000.00
MW-79C	08	139000.00
MW-76A	04	107000.00
MW-15	03	68000.00
MW-48B	09	54500.00
MW-27	06A	52700.00

◐ Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	SODIUM [UG/L]
MW-66	05	49400.00
MW-22	05	49000.00
MW-103C	BKG	42400.00
MW-21	05	41900.00
MW-71C	18A	40500.00
MW-12	07	36900.00
MW-88C	18C	36500.00
MW-SA5	151	34200.00
MW-59C	07	27900.00
MW-59C (Dup)	07	27400.00
MW-86C	15	22100.00
MW-9	01	18900.00
MW-47C	09	17600.00
MW-46A	10	17500.00
MW-56	10	11300.00
MW-49	19	8220.00
MW-57	10	7790.00
MW-58	03	6100.00
MW-82A	OI	2540.00

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	SODIUM [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR SODIUM IS 50,000 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

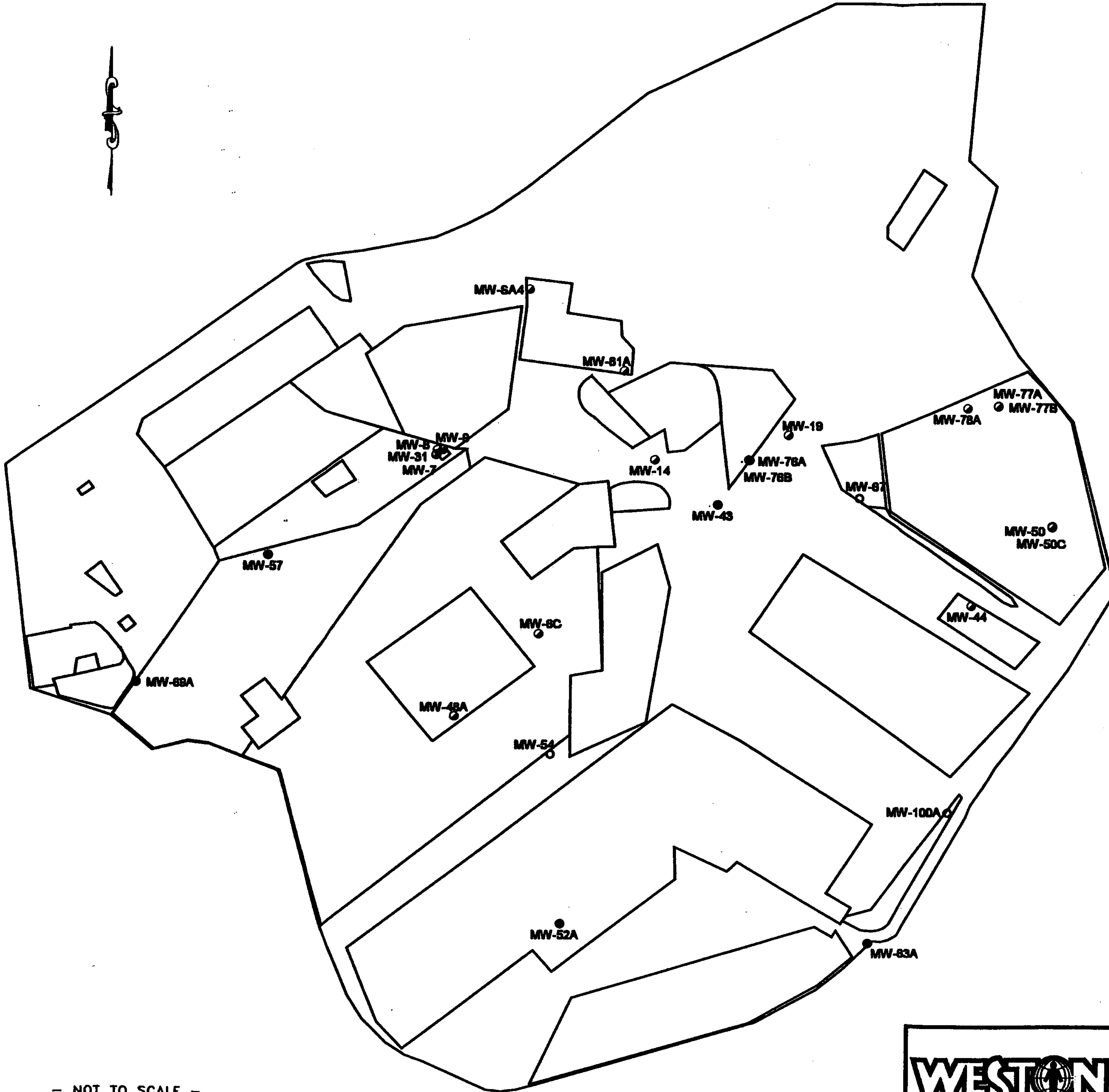
PROJECT NAME: FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1
SODIUM GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-14



• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	LEAD [UG/L]
MW-69A	XHW	31.60 J-
MW-76A	04	20.30
MW-52A	16	14.50 J-
MW-43	04	13.70
MW-57	10	11.10 J-
MW-63A	12	10.40 J-

◉ Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	LEAD [UG/L]
MW-77B	14	7.10
MW-7	01	6.90
MW-50	14	6.10 J-
MW-9	01	5.20
MW-76B	04	3.90
MW-8	01	3.90
MW-14	03	3.40
MW-78A	14	3.40
MW-31	01	3.30
MW-SA4	151	3.20
MW-48A	09	2.90
MW-77A	14	2.90
MW-19	04	2.40
MW-6C	09	2.30
MW-81A	151	1.90
MW-44	06A	1.80 J-
MW-50C	14	1.80 J-

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	LEAD [UG/L]
MW-100A	11	239.00 U
MW-67	05	15.70 U
MW-54	19	12.50 U

NOTES: THE NJDEP GWQS FOR LEAD IS 10.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

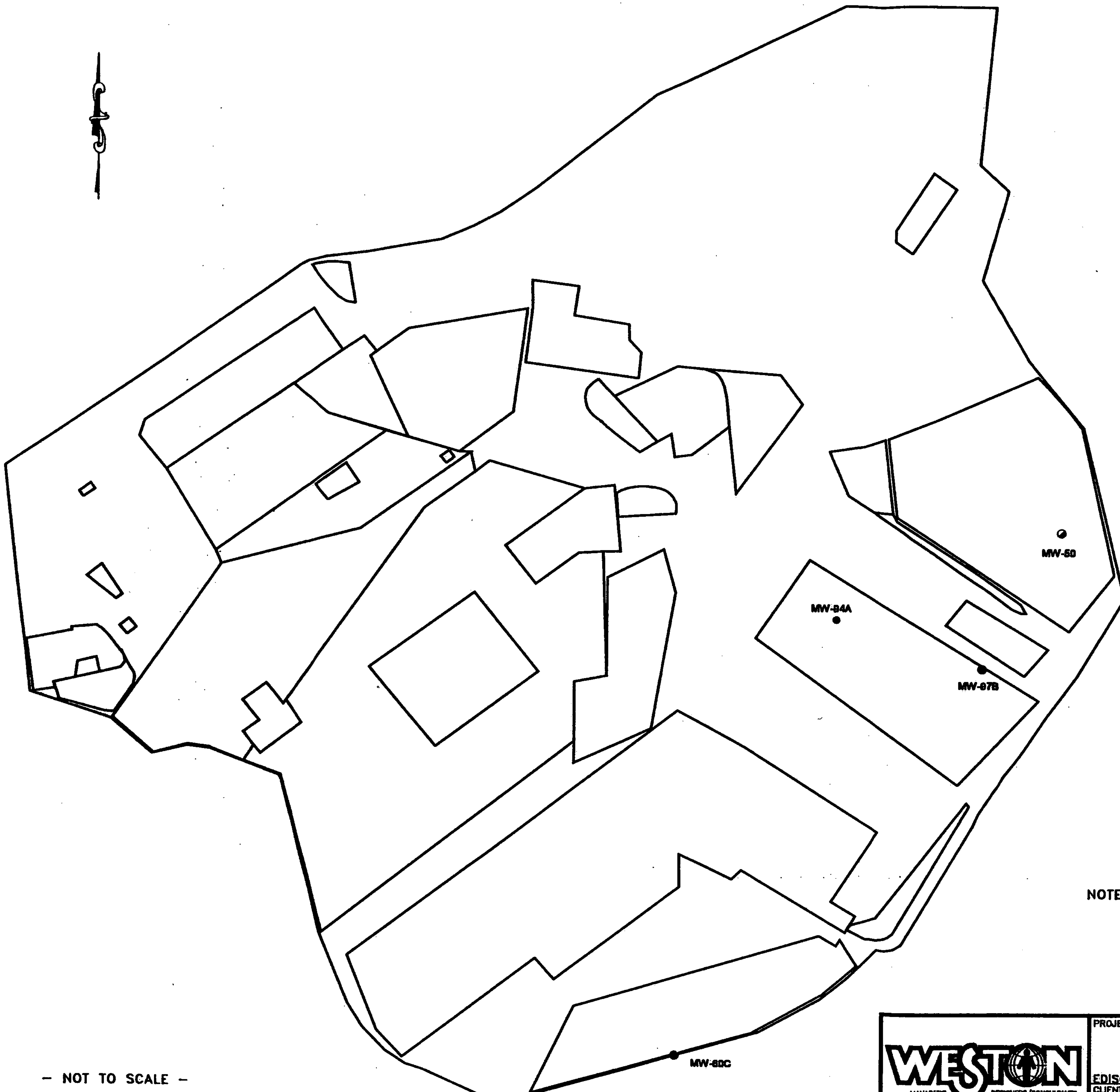
WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1
LEAD GROUNDWATER
SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-15



- NOT TO SCALE -

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	ANTIMONY [UG/L]
MW-97B	06A	39.20
MW-94A	06	28.80
MW-60C	14	27.20

Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	ANTIMONY [UG/L]
MW-50	14	13

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	ANTIMONY [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR ANTIMONY IS 20.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON MANAGERS DESIGNERS/CONSULTANTS

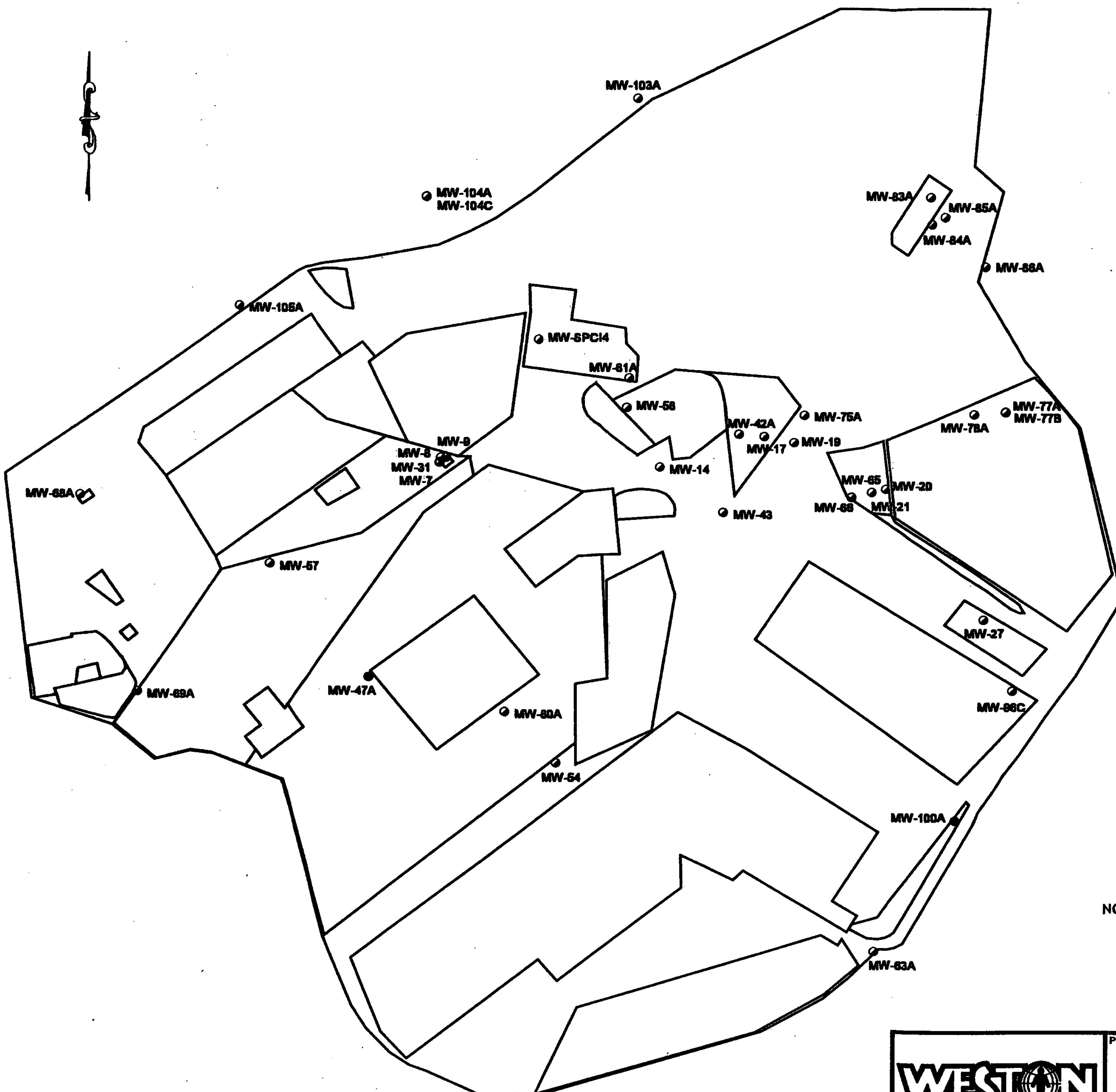
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1 ANTIMONY GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-16



– NOT TO SCALE –

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	NICKEL [UG/L]
MW-100A	11	164.00
MW-47A	09	151.00

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	NICKEL [UG/L]
None	None	None

◉ Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	NICKEL [UG/L]
MW-86A	15	75.90
MW-66	05	64.40
MW-85A	15	55.10
MW-83A	15	50.50
MW-69A	XHW	49.20
MW-21	05	47.90
MW-7	01	47.70
MW-85A (Dup)	15	46.10
MW-17	04	44.70
MW-84A	15	39.50
MW-20	05	37.20
MW-75A	04	33.40
MW-8	01	32.00
MW-96C	06	31.30
MW-57	10	30.80
MW-31	01	28.90
MW-19	04	27.30
MW-27	06A	27.20
MW-78A	14	22.90
MW-14	03	22.60
MW-80A (Dup)	09	22.40
MW-65	05	20.80
MW-54	19	20.50
MW-SPCI4	151	19.80
MW-68A	118	18.00
MW-42A	04	17.00
MW-9	01	16.80
MW-104C	BKG	16.70
MW-103A	BKG	15.80
MW-58	03	15.00
MW-105A	BKG	14.90
MW-81A	151	14.90
MW-104A	BKG	14.80
MW-77B	14	14.60
MW-80A	09	13.90
MW-43	04	13.70
MW-63A	12	13.50
MW-77A	14	13.20

NOTES: THE NJDEP GWQS FOR NICKEL IS 100 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

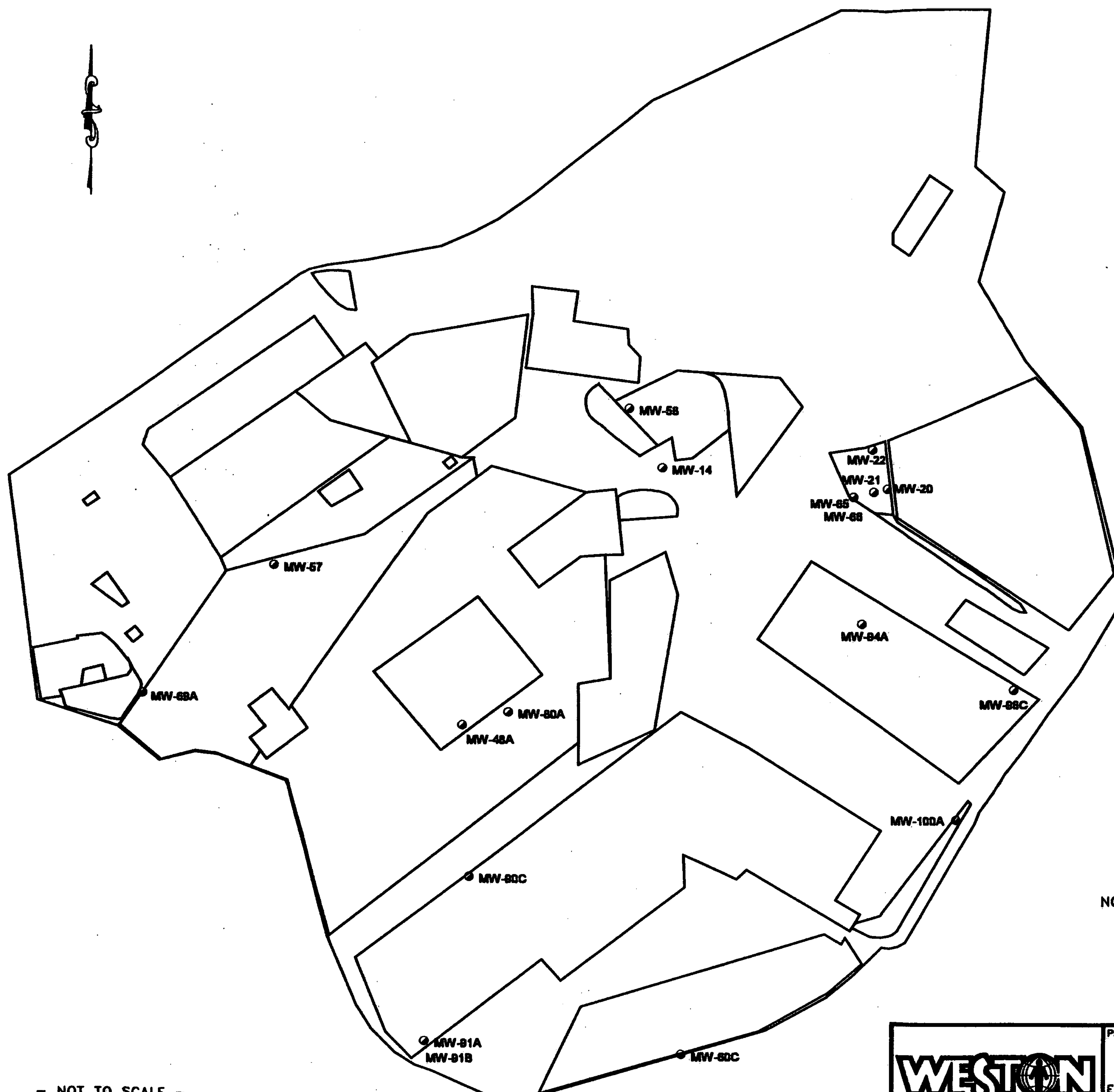
PROJECT NAME: FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1
NICKEL GROUNDWATER
SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-17



– NOT TO SCALE –

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	CADMIUM [UG/L]
None	None	None

⊘ Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	CADMIUM [UG/L]
MW-66	05	4.00
MW-22	05	3.20
MW-14	03	2.80
MW-21	05	2.20
MW-91B	16	1.80
MW-100A	11	1.50
MW-80A (Dup)	09	1.50
MW-90C	16	1.50
MW-58	03	1.40
MW-80A	09	1.40
MW-91A	16	1.30
MW-48A	09	1.20
MW-60C	12	1.20
MW-65	05	1.20
MW-69A	XHW	1.20
MW-20	05	1.10
MW-57	10	1.10
MW-94A	06	1.10
MW-96C	06	1.00

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	CADMIUM [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR CADMIUM IS 4.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

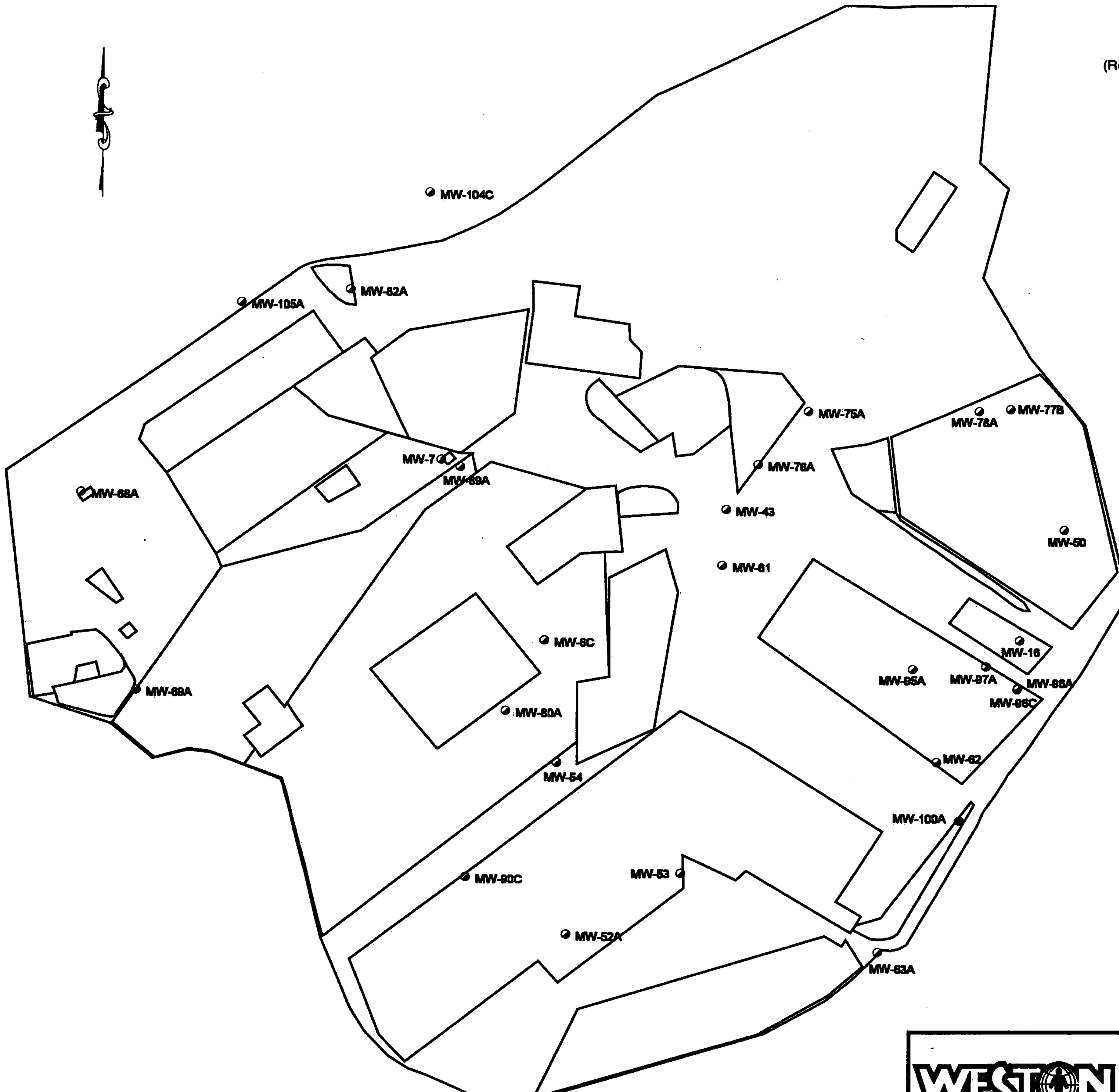
WESTON
MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1 CADMIUM GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-18



– NOT TO SCALE –

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	CHROMIUM [UG/L]
MW-100A	11	271.00 J

Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	CHROMIUM [UG/L]
MW-69A	XHW	83.20
MW-54	19	50.50 J
MW-76A	04	34.00
MW-63A	12	29.70
MW-50	14	26.10
MW-78A	14	23.70
MW-97A	06A	22.20
MW-96C	06	17.40
MW-89A	01	15.00
MW-43	04	14.50
MW-61	04	13.80
MW-104C	BKG	13.10
MW-7	01	12.90
MW-62	06	11.80
MW-105A	BKG	11.70
MW-80A	09	11.40 J
MW-95A	06	11.40
MW-68A	118	10.20
MW-90C	16	10.10
MW-16	06A	8.90
MW-53	16	8.60
MW-82A	OI	8.50
MW-77B	14	8.10
MW-75A	04	7.90
MW-6C	09	7.70
MW-52A	16	7.60
MW-96A	06	7.00

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	CHROMIUM [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR CHROMIUM IS 100 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

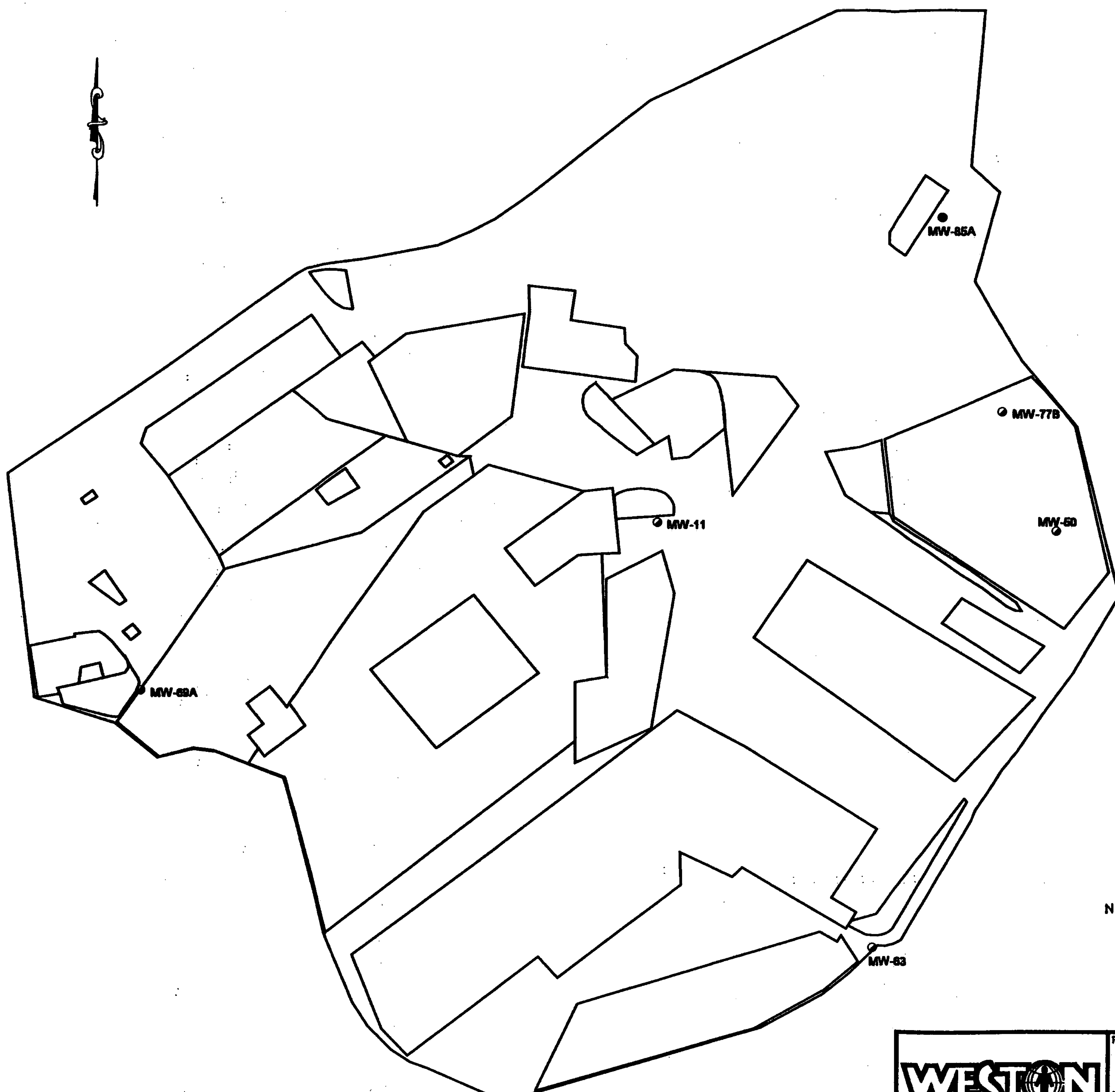
PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

ROUND 1
CHROMIUM GROUNDWATER
SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-19



– NOT TO SCALE –

Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	MERCURY [UG/L]
MW-85A (Dup)	15	3 J

Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	MERCURY [UG/L]
MW-11	07	0.29 J
MW-77B	14	0.27 J
MW-50	14	0.27
MW-69A	XHW	0.26
MW-63	12	0.23
MW-85A	15	0.20 J

Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	MERCURY [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR MERCURY IS 2.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

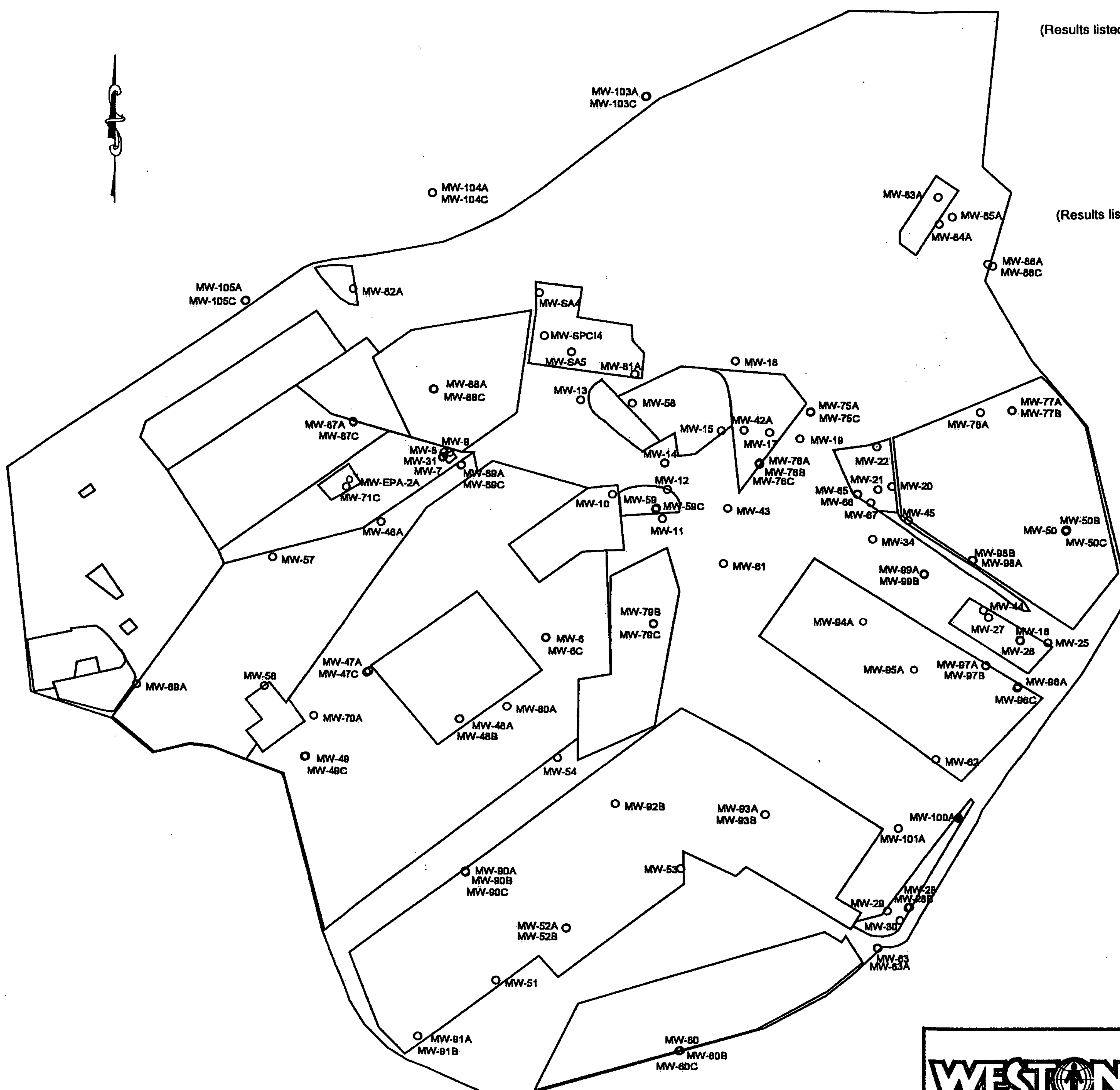
PROJECT NAME: FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 1
MERCURY GROUNDWATER
SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-20



- NOT TO SCALE -

• Round 1 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	ALDRIN [UG/L]
MW-100A	11	0.0420

• Round 1 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	ALDRIN [UG/L]
None	None	None

○ Round 1 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	ALDRIN [UG/L]
MW-103C	BKG	0.0680 U
MW-46A	10	0.0600 U
MW-53	16	0.0590 U
MW-9	01	0.0590 U
MW-56	10	0.0580 U
MW-63A	12	0.0580 U
MW-7	01	0.0580 U
MW-90A	16	0.0580 U
MW-10	20	0.0560 U
MW-104C	BKG	0.0560 U
MW-13	02	0.0560 U
MW-18	04	0.0560 U
MW-45	14	0.0560 U
MW-48B	09	0.0560 U
MW-52B	16	0.0560 U
MW-54	19	0.0560 U
MW-98B	06A	0.0560 U
MW-43	04	0.0550 U
MW-50	14	0.0550 U
MW-58	03	0.0550 U
MW-59	07	0.0550 U
MW-90C	16	0.0550 U
MW-95A	06	0.0550 U
MW-49C (Dup)	19	0.0540 U
MW-21	05	0.0540 U
MW-22	05	0.0540 U
MW-25	06A	0.0540 U
MW-26	06A	0.0540 U
MW-31	01	0.0540 U
MW-49C	19	0.0540 U
MW-51	16	0.0540 U
MW-57	10	0.0540 U
MW-6	19	0.0540 U
MW-60	12	0.0540 U
MW-65	05	0.0540 U
MW-75A	04	0.0540 U
MW-76A	04	0.0540 U
MW-77A	14	0.0540 U
MW-81A	151	0.0540 U
MW-85A	15	0.0540 U
MW-86A	15	0.0540 U
MW-88A	18C	0.0540 U
MW-89C	01	0.0540 U
MW-93A	16	0.0540 U
MW-44	06A	0.0530 U
MW-70A	10	0.0530 U
MW-75C	04	0.0530 U
MW-76B	04	0.0530 U
MW-79C	08	0.0530 U
MW-90B	16	0.0530 U
MW-96A	06	0.0530 U
MW-99B	06B	0.0530 U
MW-101A	11	0.0520 U
MW-103A	BKG	0.0520 U
MW-105A	BKG	0.0520 U
MW-105C	BKG	0.0520 U
MW-12	07	0.0520 U
MW-16	06A	0.0520 U
MW-17	04	0.0520 U
MW-20	05	0.0520 U
MW-85A (Dup)	15	0.0520 U
MW-93B (Dup)	16	0.0520 U

LOCATION	AREA	ALDRIN [UG/L]
MW-97B	06A	0.0520 U
MW-27	06A	0.0520 U
MW-29	11	0.0520 U
MW-30	11	0.0520 U
MW-34	06B	0.0520 U
MW-42A	04	0.0520 U
MW-47A	09	0.0520 U
MW-47C	09	0.0520 U
MW-49	19	0.0520 U
MW-60B	12	0.0520 U
MW-60C	12	0.0520 U
MW-61	04	0.0520 U
MW-62	06	0.0520 U
MW-63	12	0.0520 U
MW-66	05	0.0520 U
MW-69A	XHW	0.0520 U
MW-6C	09	0.0520 U
MW-76C	04	0.0520 U
MW-78A	14	0.0520 U
MW-82A	OI	0.0520 U
MW-87A	18D	0.0520 U
MW-87C	18D	0.0520 U
MW-88C	18C	0.0520 U
MW-89A	01	0.0520 U
MW-91B	16	0.0520 U
MW-92B	16	0.0520 U
MW-94A	06	0.0520 U
MW-96C	06	0.0520 U
MW-97B (Dup)	06A	0.0520 U
MW-98A	06B	0.0520 U
MW-99A	06B	0.0520 U
MW-EPA2A	18A	0.0520 U
MW-SPCI4	151	0.0520 U
MW-15	03	0.0510 U
MW-19	04	0.0510 U
MW-80A (Dup)	09	0.0510 U
MW-28B	11	0.0510 U
MW-48A	09	0.0510 U
MW-50B	14	0.0510 U
MW-50C	14	0.0510 U
MW-59C	07	0.0510 U
MW-67	05	0.0510 U
MW-8	01	0.0510 U
MW-93B	16	0.0510 U
MW-97A	06A	0.0510 U
MW-SA4	151	0.0510 U
MW-SA5	151	0.0510 U
MW-104A	BKG	0.0500 U
MW-11	07	0.0500 U
MW-14	03	0.0500 U
MW-59C (Dup)	07	0.0500 U
MW-28	11	0.0500 U
MW-52A	16	0.0500 U
MW-71C	18A	0.0500 U
MW-77B	14	0.0500 U
MW-79B	08	0.0500 U
MW-80A	09	0.0500 U
MW-83A	15	0.0500 U
MW-84A	15	0.0500 U
MW-86C	15	0.0500 U
MW-91A	16	0.0500 U

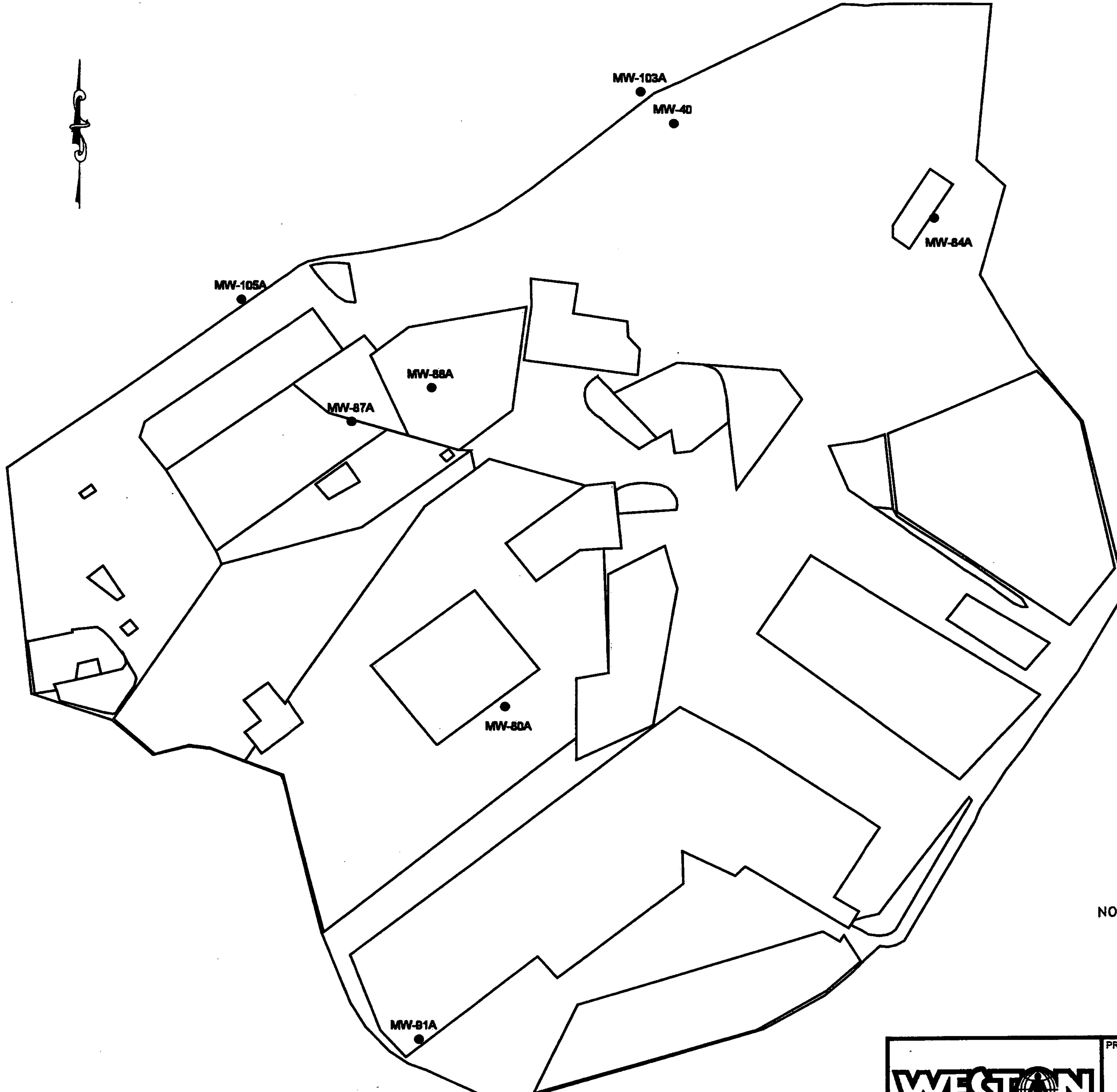
NOTES: THE NJDEP GWQS FOR ALDRIN IS 0.04 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON MANAGERS DESIGNERS/CONSULTANTS	PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY	ROUND 1 ALDRIN GROUNDWATER SAMPLING RESULTS
	CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS	DATE: JUNE 1995 FIGURE #: 5-21

WO #: 03886-062-010-0000 DATE 6/9/95 FILE NAME: TBLR21.DWG DRAWN BY: B. MAC



Round 2 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	TRICHLOROETHLYENE (TCE) [UG/L]
MW-91A	16	32.00
MW-80A	09	12.00
MW-103A	BKG	8.00
MW-40	BKG	8.00
MW-84A	15	8.00
MW-87A	18D	5.00
MW-105A	BKG	3.00
MW-88A	18C	3.00

Round 2 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	TRICHLOROETHLYENE (TCE) [UG/L]
None	None	None

Round 2 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	TRICHLOROETHLYENE (TCE) [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR TRICHLOROETHYLENE IS 1.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

– NOT TO SCALE –

WESTON MANAGERS DESIGNERS/CONSULTANTS

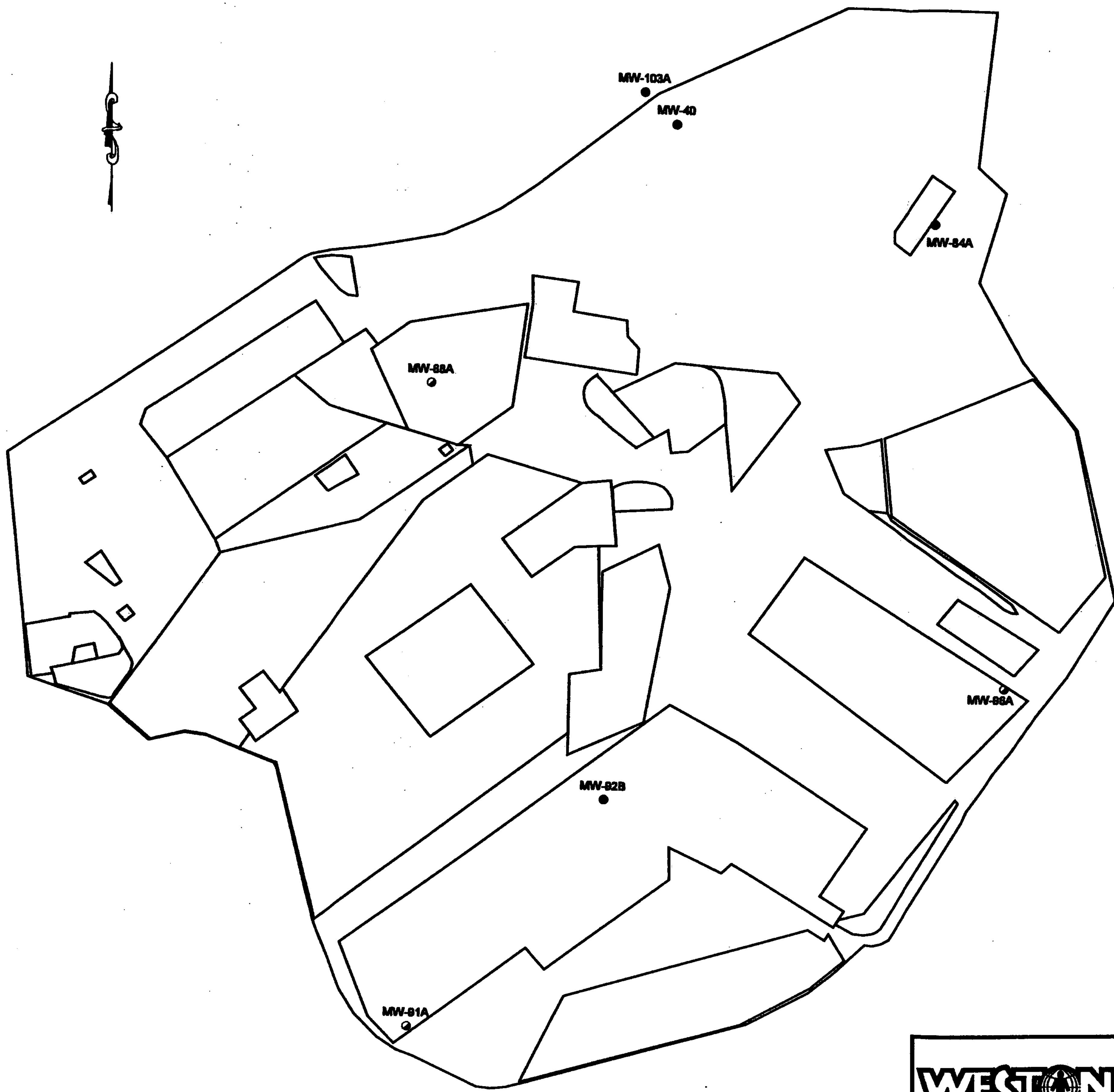
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 2 TRICHLOROETHYLENE (TCE) GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-22



- NOT TO SCALE -

● **Round 2 > GWQS**

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	1,2-DICHLOROETHENE [UG/L]
MW-103A	BKG	48.00
MW-84A	15	22.00
MW-92B	16	19.00
MW-40	BKG	11.00

◉ **Round 2 <= GWQS**

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	1,2-DICHLOROETHENE [UG/L]
MW-88A	01	10.00
MW-91A	16	2.00
MW-96A	06	2.00

○ **Round 2 = ND**

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	1,2-DICHLOROETHENE [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR TOTAL 1,2-DICHLOROETHENE IS 10.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON MANAGERS DESIGNERS/CONSULTANTS

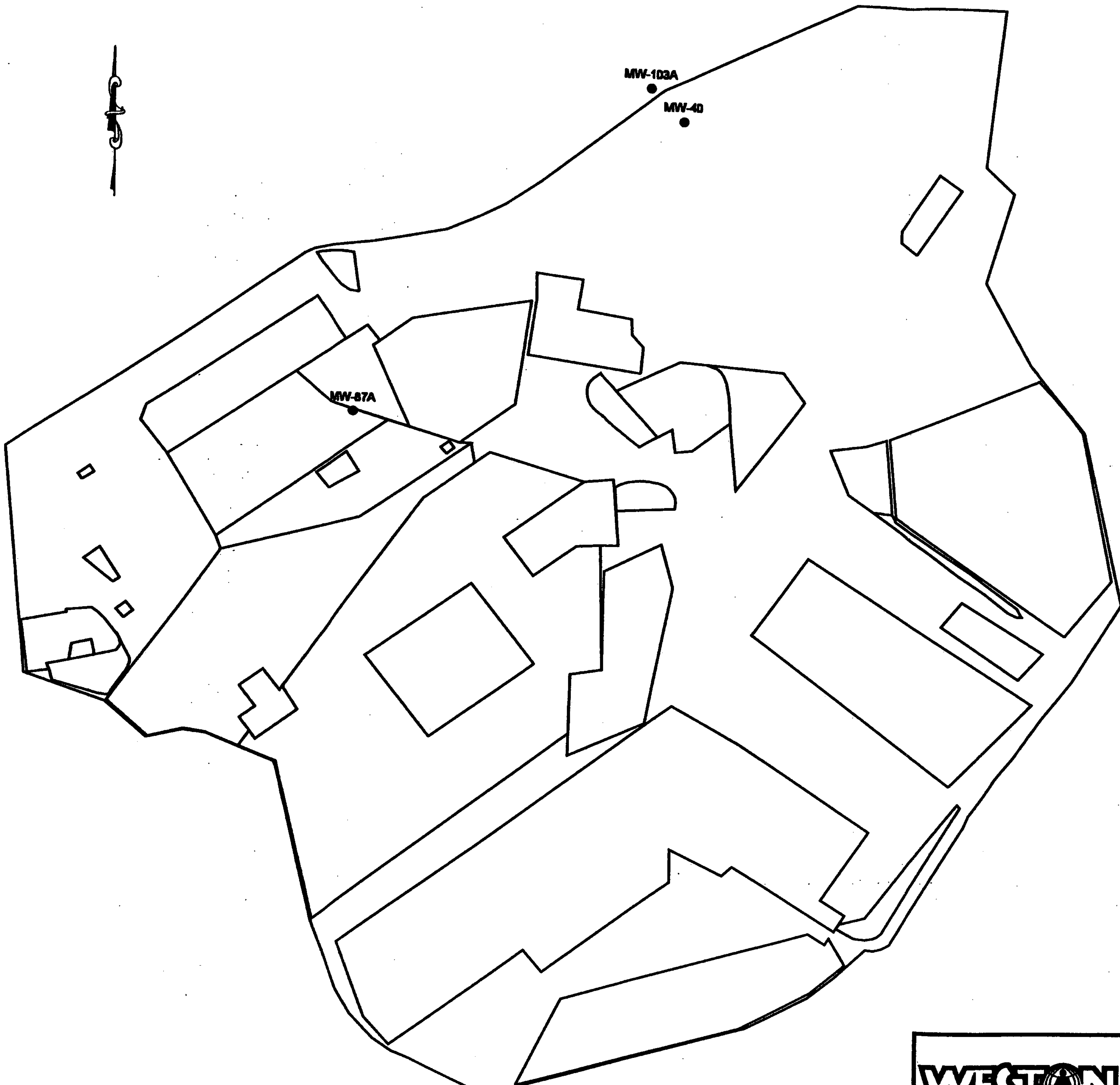
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 2 TOTAL 1,2-DICHLOROETHENE GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-23



- NOT TO SCALE -

● **Round 2 > GWQS**

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	TETRACHLOROETHYLENE(PCE) [UG/L]
MW-103A	BKG	8.00
MW-40	BKG	3.00
MW-87A	01	2.00

◉ **Round 2 <= GWQS**

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	TETRACHLOROETHYLENE(PCE) [UG/L]
None	None	None

○ **Round 2 = ND**

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	TETRACHLOROETHYLENE(PCE) [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR TETRACHLOROETHYLENE IS 1.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

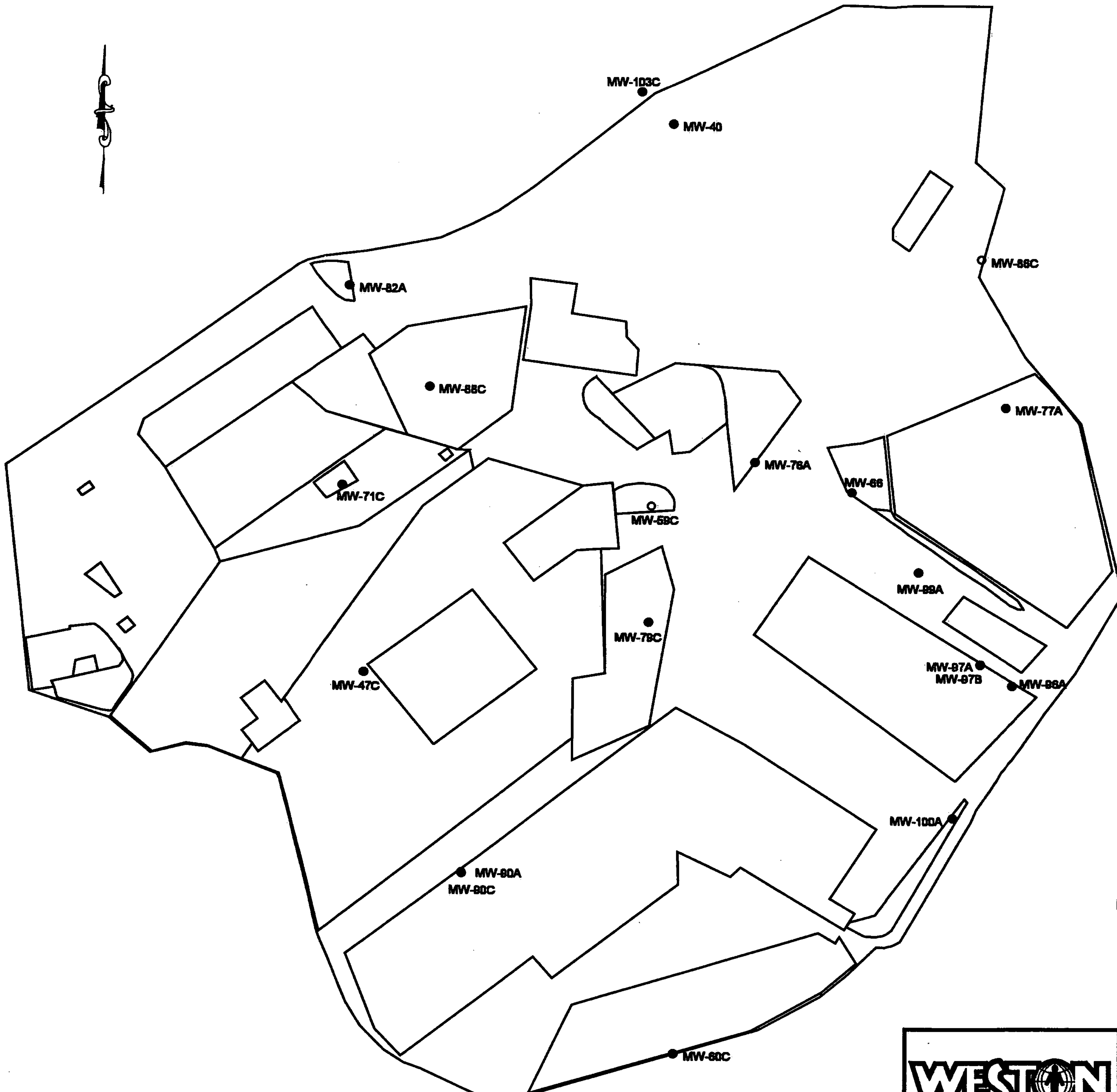
PROJECT NAME:
FORMER RARITAN ARSENAL
PHASE II
REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME:
U.S. ARMY CORPS OF ENGINEERS

ROUND 2
TETRACHLOROETHYLENE (PCE)
GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-24



- NOT TO SCALE -

• Round 2 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	MANGANESE [UG/L]
MW-90C	16	5770
MW-79C	08	1970
MW-66	05	1460
MW-77A	14	1270
MW-100A	11	1120
MW-90A	16	886
MW-76A	04	741
MW-97B	06A	650
MW-96A	06	412
MW-97A	06A	409
MW-60C	12	269
MW-99A	06B	256
MW-47C	09	251
MW-99A (Dup)	06B	247
MW-82A	OI	127
MW-40	BKG	119
MW-71C	18A	91.7
MW-103C	BKG	81.2
MW-88C	18C	54.9

◉ Round 2 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	MANGANESE [UG/L]
None	None	None

○ Round 2 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	MANGANESE [UG/L]
MW-59C	07	53.8 U

NOTES: THE NJDEP GWQS FOR MANGANESE IS 50.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON MANAGERS DESIGNERS/CONSULTANTS

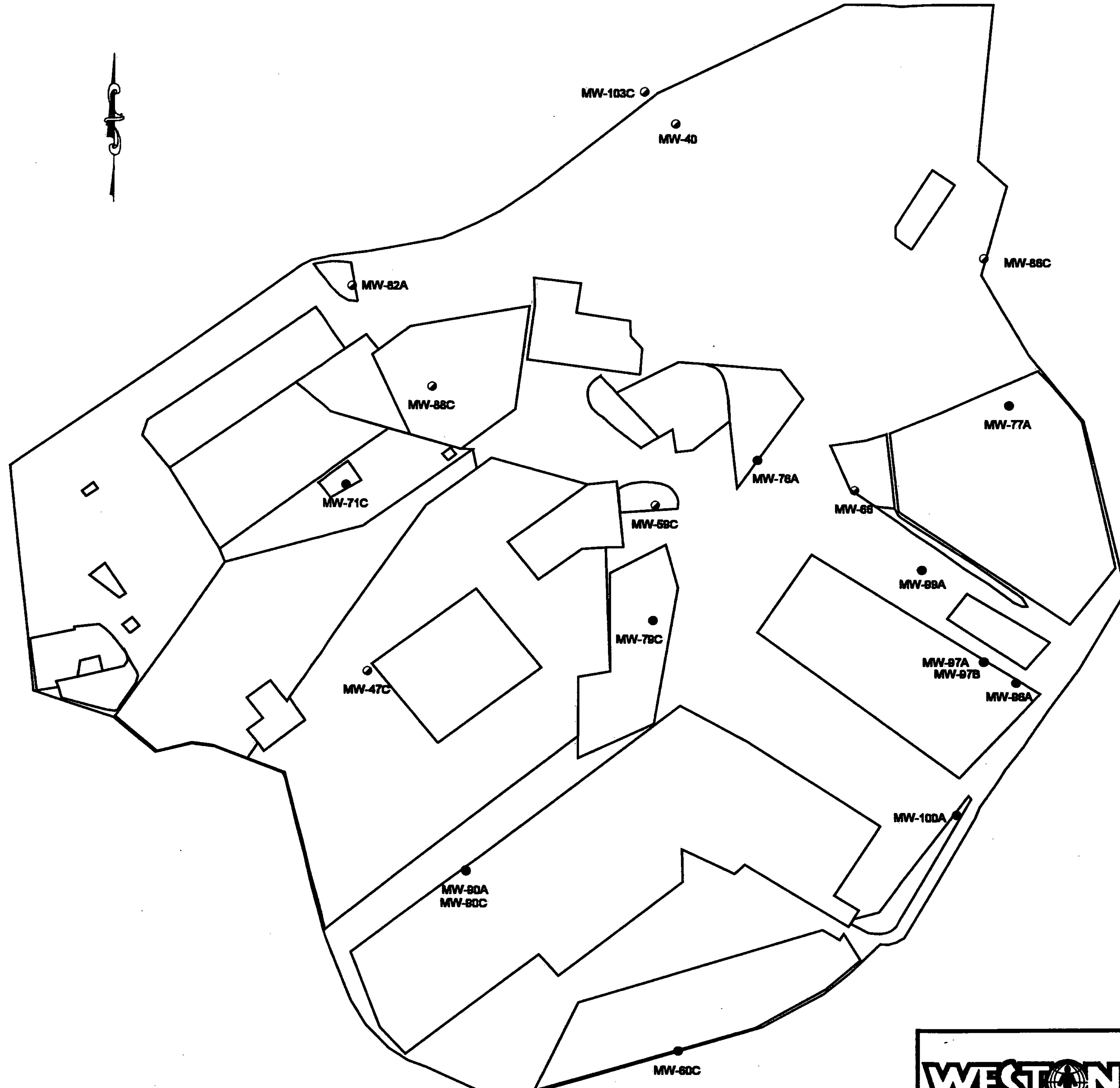
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 2 MANGANESE GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-25



- NOT TO SCALE -

• Round 2 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	SODIUM [UG/L]
MW-97B	06A	3900000
MW-60C	12	3820000
MW-97A	06A	3340000
MW-90C	16	2300000
MW-96A	06	1890000
MW-71C	18A	1840000 J+
MW-90A	16	1840000
MW-99A	06B	1580000
MW-99A (Dup)	06B	1540000
MW-100A	11	286000
MW-77A	14	197000
MW-76A	04	144000
MW-79C	08	123000

Round 2 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	SODIUM [UG/L]
MW-66	05	46700
MW-103C	BKG	40900
MW-40	BKG	38800 J+
MW-88C	18C	37800 J+
MW-59C	07	26800
MW-86C	15	21500
MW-47C	09	17800
MW-82A	OI	2690 J+

○ Round 2 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	SODIUM [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR SODIUM IS 50,000 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS. DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON MANAGERS DESIGNERS/CONSULTANTS

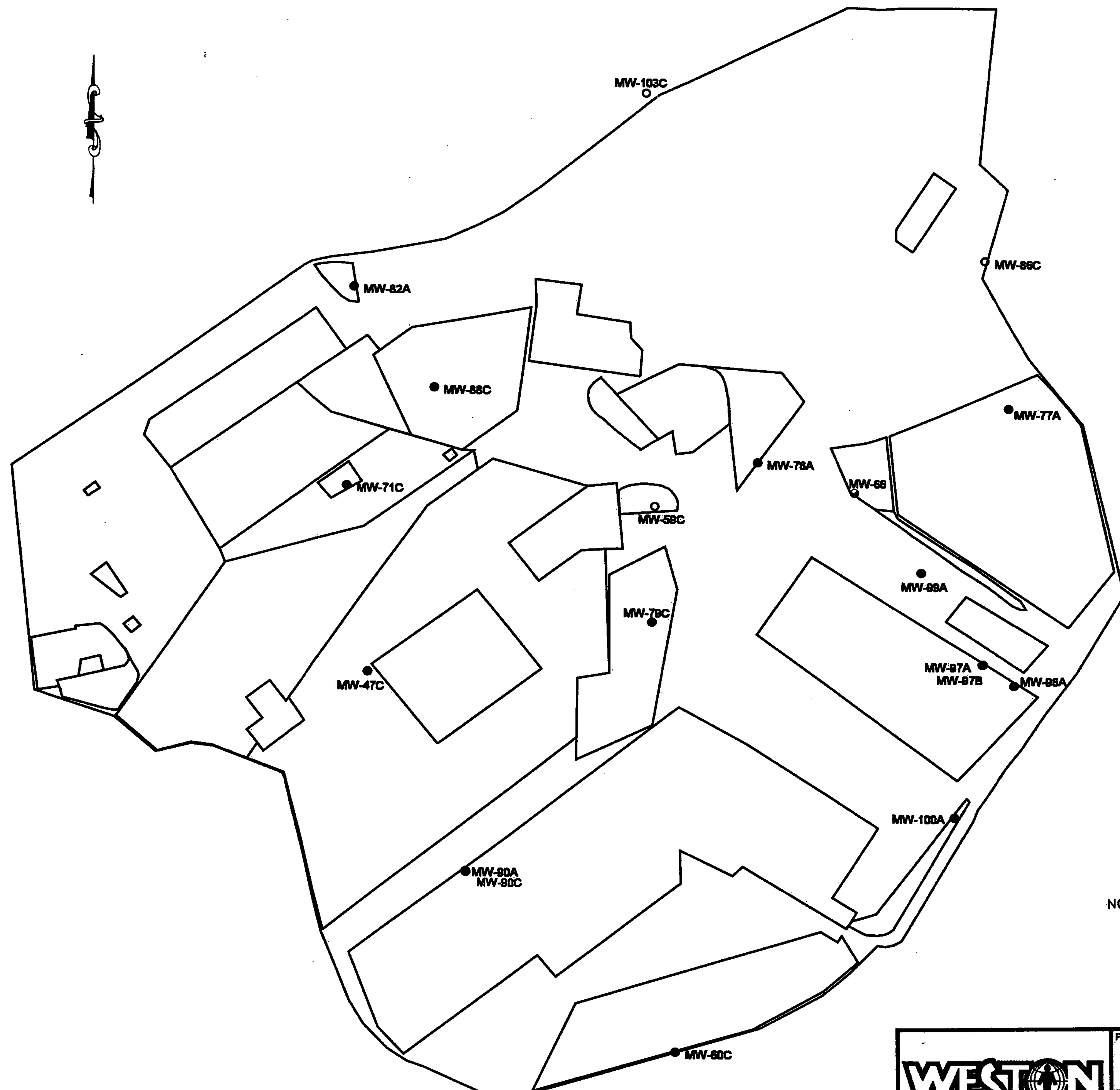
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 2 SODIUM GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-26



- NOT TO SCALE -

• Round 2 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	IRON [UG/L]
MW-76A	04	28900
MW-90A	16	28500
MW-97B	06A	25900
MW-77A	14	24700
MW-97A	06A	15900
MW-79C	08	13500
MW-100A	11	11900
MW-99A (Dup)	06B	11200
MW-99A	06B	11100
MW-90C	16	10500
MW-60C	12	6600
MW-47C	09	5960
MW-96A	06	5120
MW-82A	OI	4010
MW-71C	18A	1670
MW-88C	18C	500

◉ Round 2 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	IRON [UG/L]
MW-66	05	106

○ Round 2 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	IRON [UG/L]
MW-103C	BKG	1300 U
MW-59C	07	423 U

NOTES: THE NJDEP GWQS FOR IRON IS 300 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON MANAGERS DESIGNERS/CONSULTANTS

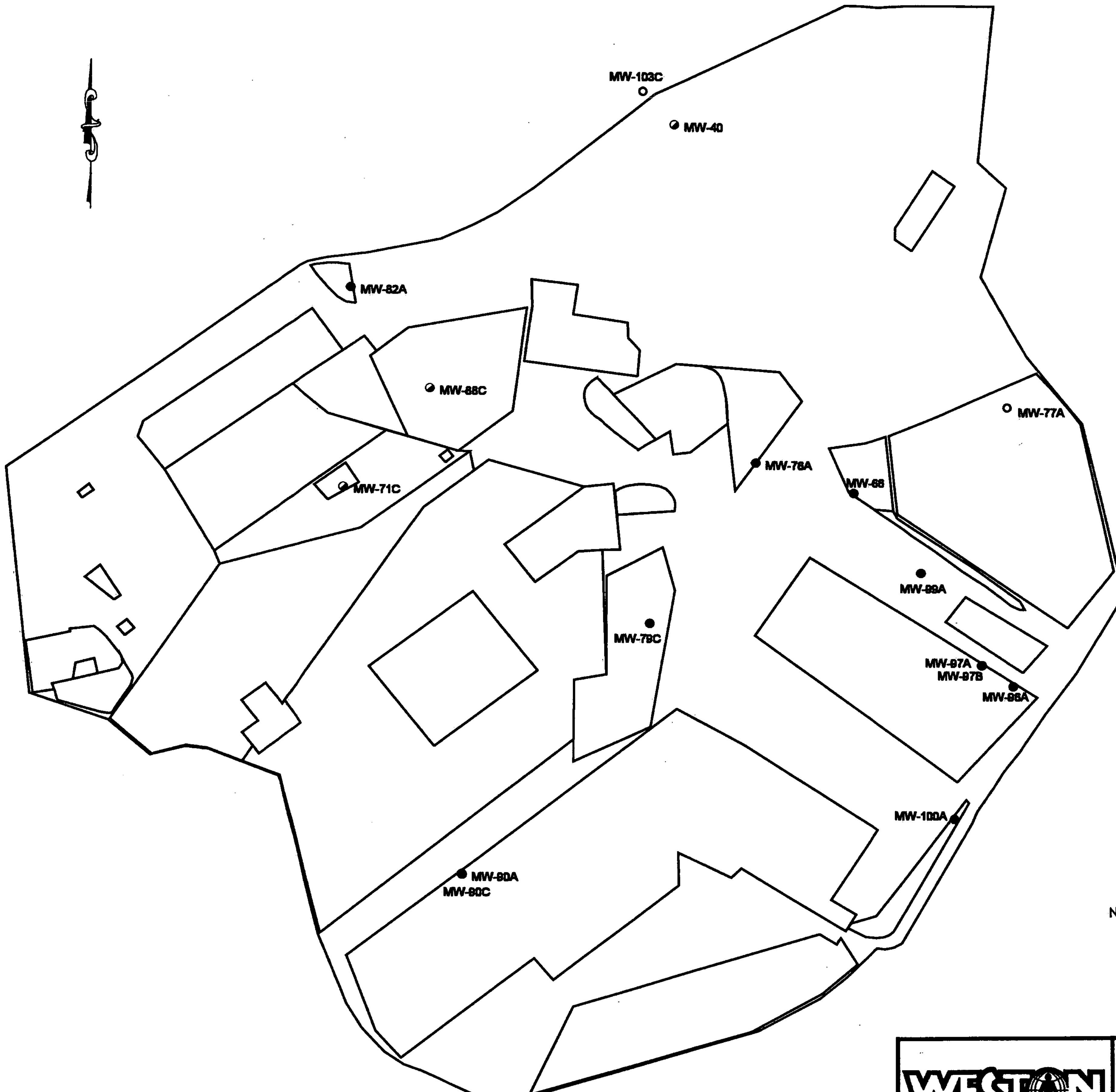
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 2 IRON GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-27



- NOT TO SCALE -

• Round 2 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	ALUMINUM [UG/L]
MW-79C	08	7850 J
MW-76A	04	6010
MW-90A	16	1730
MW-100A	11	1530 J
MW-82A	OI	1510
MW-96A	06	648 J
MW-90C	16	554
MW-99A (Dup)	06B	525 J
MW-66	05	399
MW-99A	06B	365 J
MW-97A	06A	332
MW-97B	06A	226

Round 2 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	ALUMINUM [UG/L]
MW-88C	18C	120
MW-40	BKG	30.4
MW-71C	18A	29.9

Round 2 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	ALUMINUM [UG/L]
MW-77A	14	288 U
MW-103C	BKG	226 U

NOTES: THE NJDEP GWQS FOR ALUMINUM IS 200 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS. DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON MANAGERS DESIGNERS/CONSULTANTS

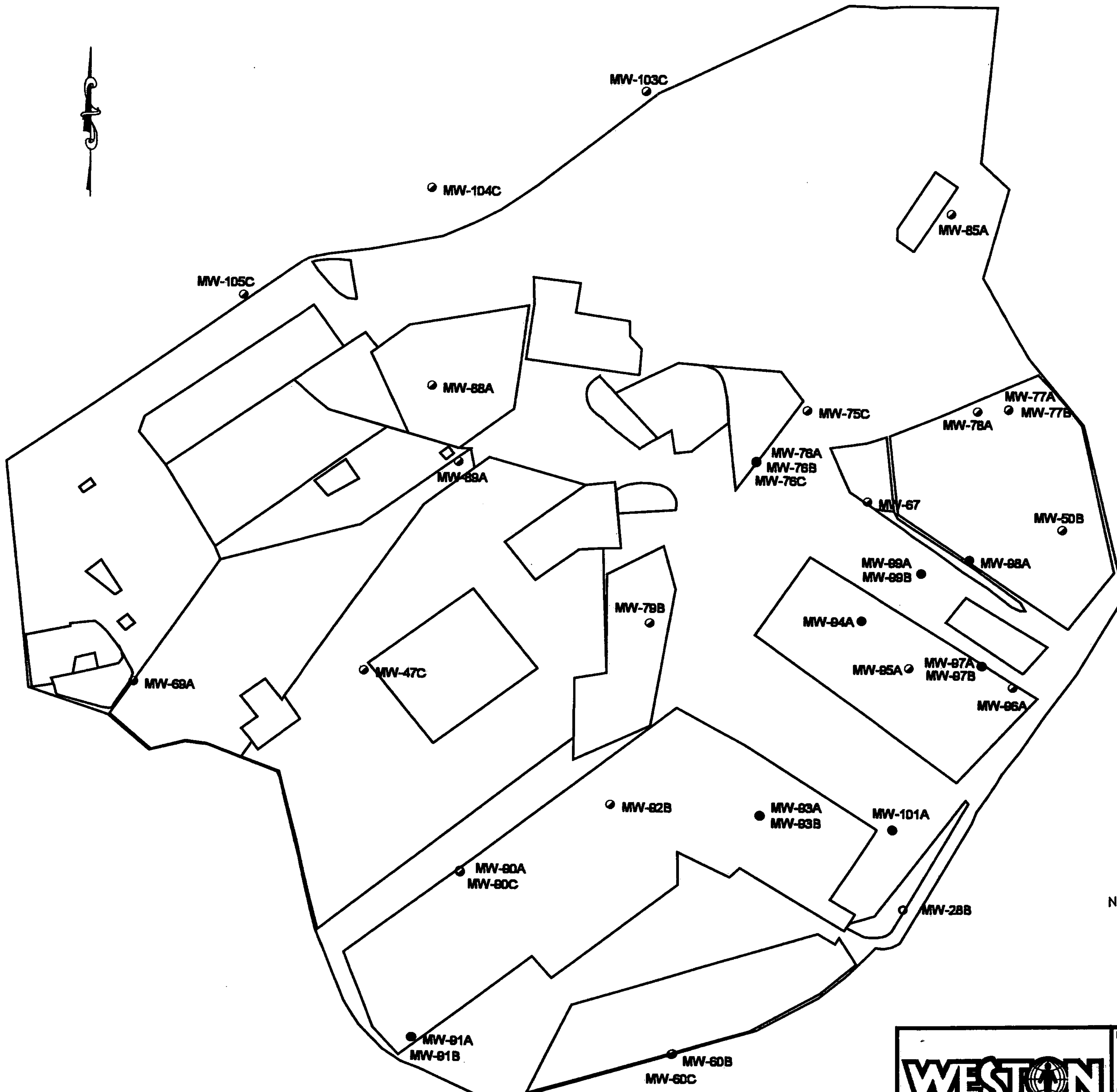
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 2 ALUMINUM GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-28



- NOT TO SCALE -

• Round 2 > GWQS

LOCATION	AREA	ARSENIC [UG/L]
MW-97A	06A	22.50
MW-101A	11	20.60
MW-99A (Dup)	06B	17.00
MW-99A	06B	16.90
MW-94A	06	15.50 J-
MW-98A	06B	15.20
MW-93A	16	12.40 J-
MW-91A	16	12.30 J-
MW-76B	04	11.10

Round 2 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	ARSENIC [UG/L]
MW-96A	06	6.50
MW-77A	14	5.60
MW-60B	12	5.40 J-
MW-90A	16	5.20 J-
MW-76A	04	5.20
MW-89A	01	4.10 J-
MW-92B	16	3.90 J-
MW-60C	12	3.80 J-
MW-67	05	3.60 J-
MW-95A	06	3.50 J-
MW-50B	14	3.40
MW-104C	BKG	3.20
MW-77B	14	2.90
MW-91B	16	2.40 J-
MW-103C	BKG	2.40
MW-76C	04	2.40
MW-78A	14	2.40
MW-69A	XHW	2.20 J-
MW-47C	09	2.20
MW-75C	04	2.10
MW-85A	15	2.00
MW-79B	08	1.90
MW-105C	BKG	1.80
MW-88A	18C	1.80

○ Round 2 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	ARSENIC [UG/L]
MW-101A (Dup)	11	19.00 U
MW-28B	11	19.00 U
MW-99B	06B	19.00 U
MW-90C	16	8.50 U
MW-97B	06A	8.50 U
MW-93B	16	8.50 UJ

NOTES: THE NJDEP GWQS FOR ARSENIC IS 8.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS. DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

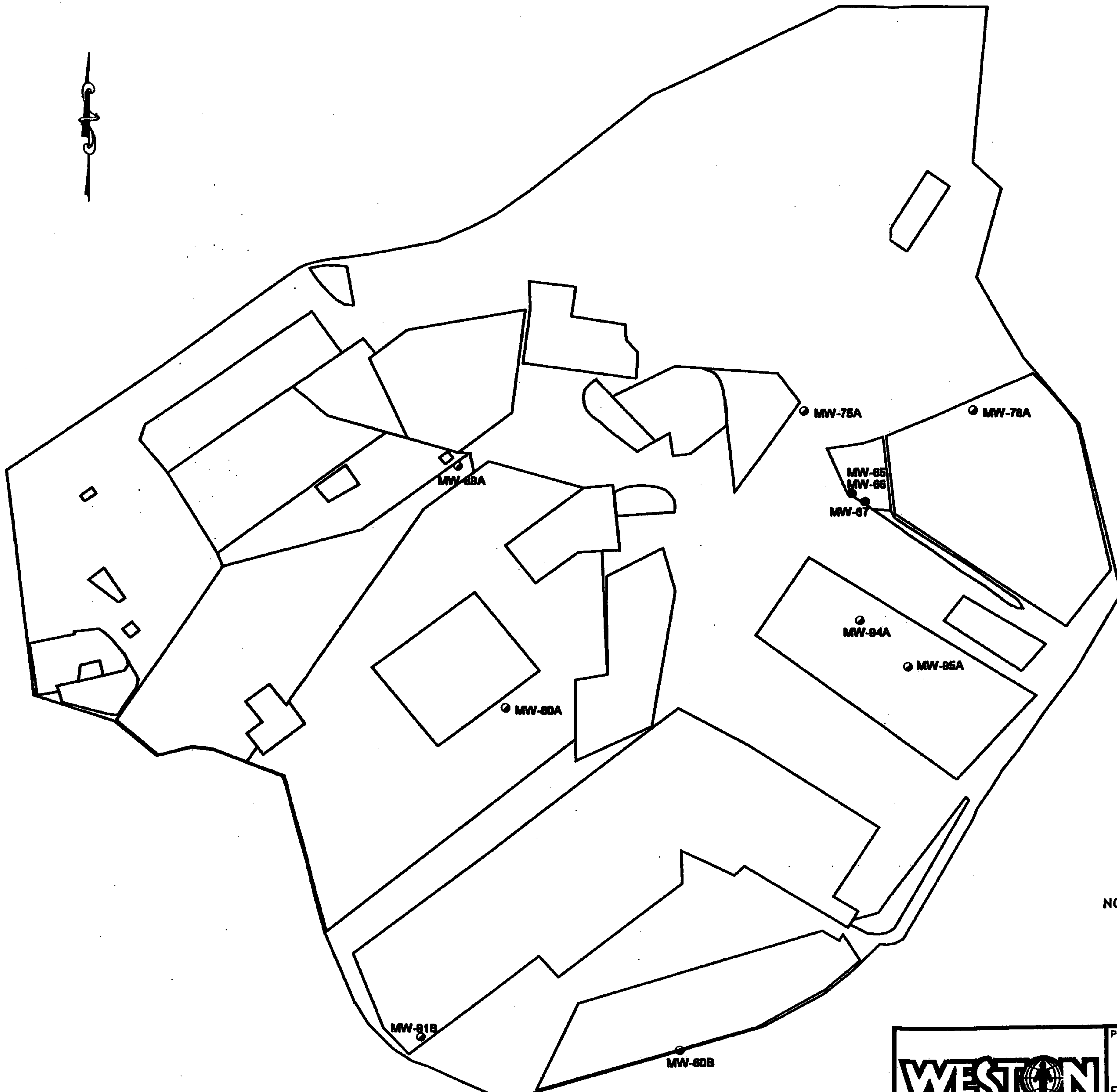
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 2 ARSENIC GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-29



- NOT TO SCALE -

● **Round 2 > GWQS**

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	CADMIUM [UG/L]
MW-67	05	5.00 J-
MW-66	05	4.30 J+

◉ **Round 2 <= GWQS**

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	CADMIUM [UG/L]
MW-89A	01	3.00 J-
MW-91B	16	3.00 J-
MW-60B	12	2.20 J-
MW-78A	14	2.10
MW-80A	09	2.10
MW-65	05	2.00 J-
MW-94A	06	2.00 J-
MW-95A	06	2.00 J-
MW-75A	04	1.20

○ **Round 2 = ND**

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	CADMIUM [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR CADMIUM IS 4.0 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS.
DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

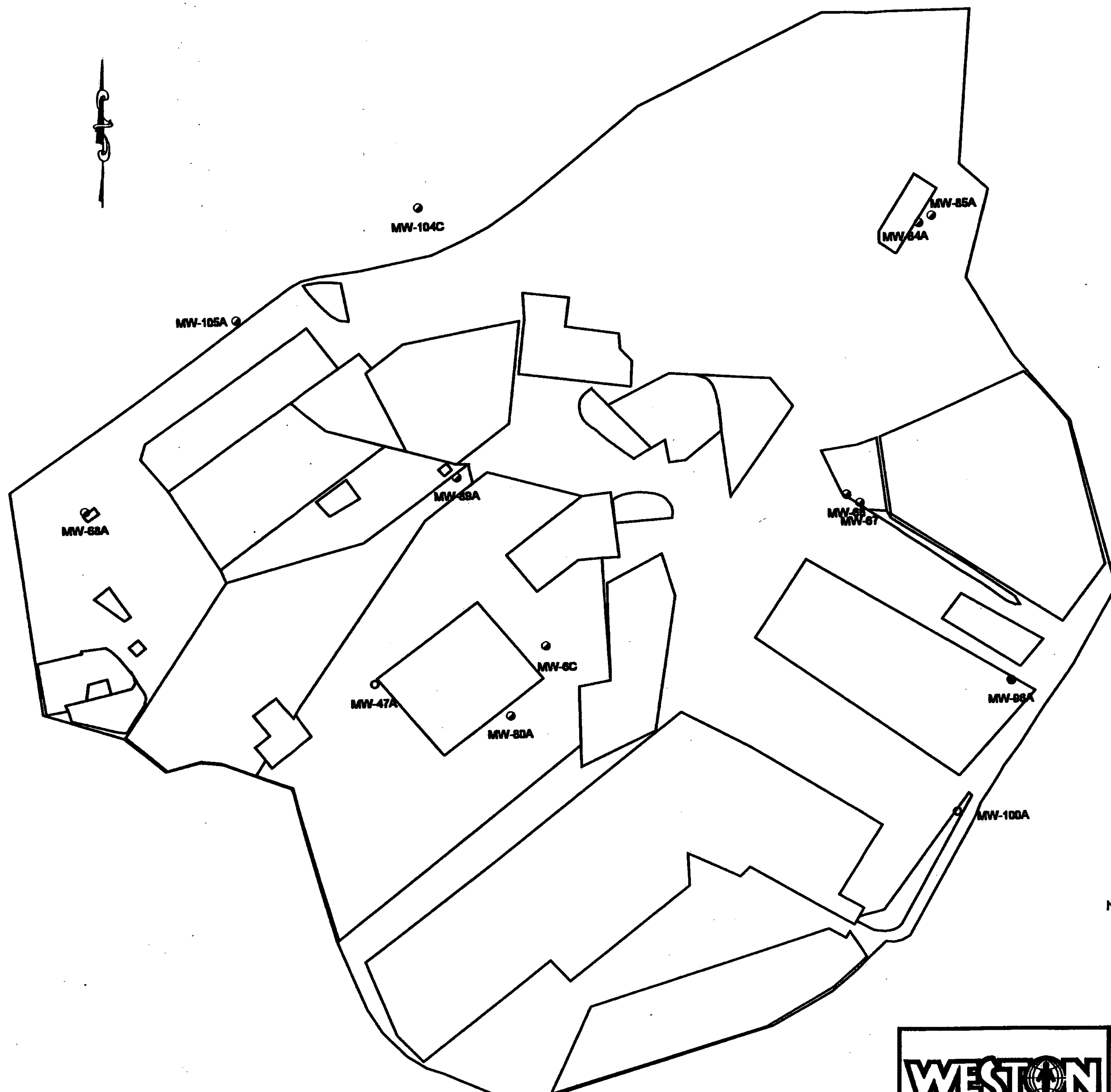
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 2
CADMIUM GROUNDWATER
SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-30



- NOT TO SCALE -

● Round 2 > GWQS

(Results listed exceed Groundwater Quality Standard)

LOCATION	AREA	NICKEL [UG/L]
MW-96A	06	172.00

◐ Round 2 <= GWQS

(Results listed are less than or equal to the GWQS)

LOCATION	AREA	NICKEL [UG/L]
MW-66	05	75.00
MW-85A	15	51.20
MW-65	05	36.60
MW-67	05	33.40
MW-68A	118	30.70
MW-89A	01	30.10
MW-104C	BKG	21.30
MW-105A	BKG	15.40
MW-84A	15	15.10
MW-80A	09	14.40
MW-6C	09	13.10

○ Round 2 = ND

(ND = Not Detected, with the detection limit provided)

LOCATION	AREA	NICKEL [UG/L]
None	None	None

NOTES: THE NJDEP GWQS FOR NICKEL IS 100 UG/L.

AREA ID DENOTES THE PHYSICAL LOCATION OF WELLS. DATA MAYBE APPLICABLE TO OTHER AREAS, DEPENDING UPON LOCATIONS.

FOR COUPLETS/TRIPLETS, SYMBOLS CHOSEN DENOTE HIGHEST CONCENTRATION OF CONTAMINANT. REFER TO TABLES FOR EACH WELL RESULT.

WESTON
MANAGERS DESIGNERS/CONSULTANTS

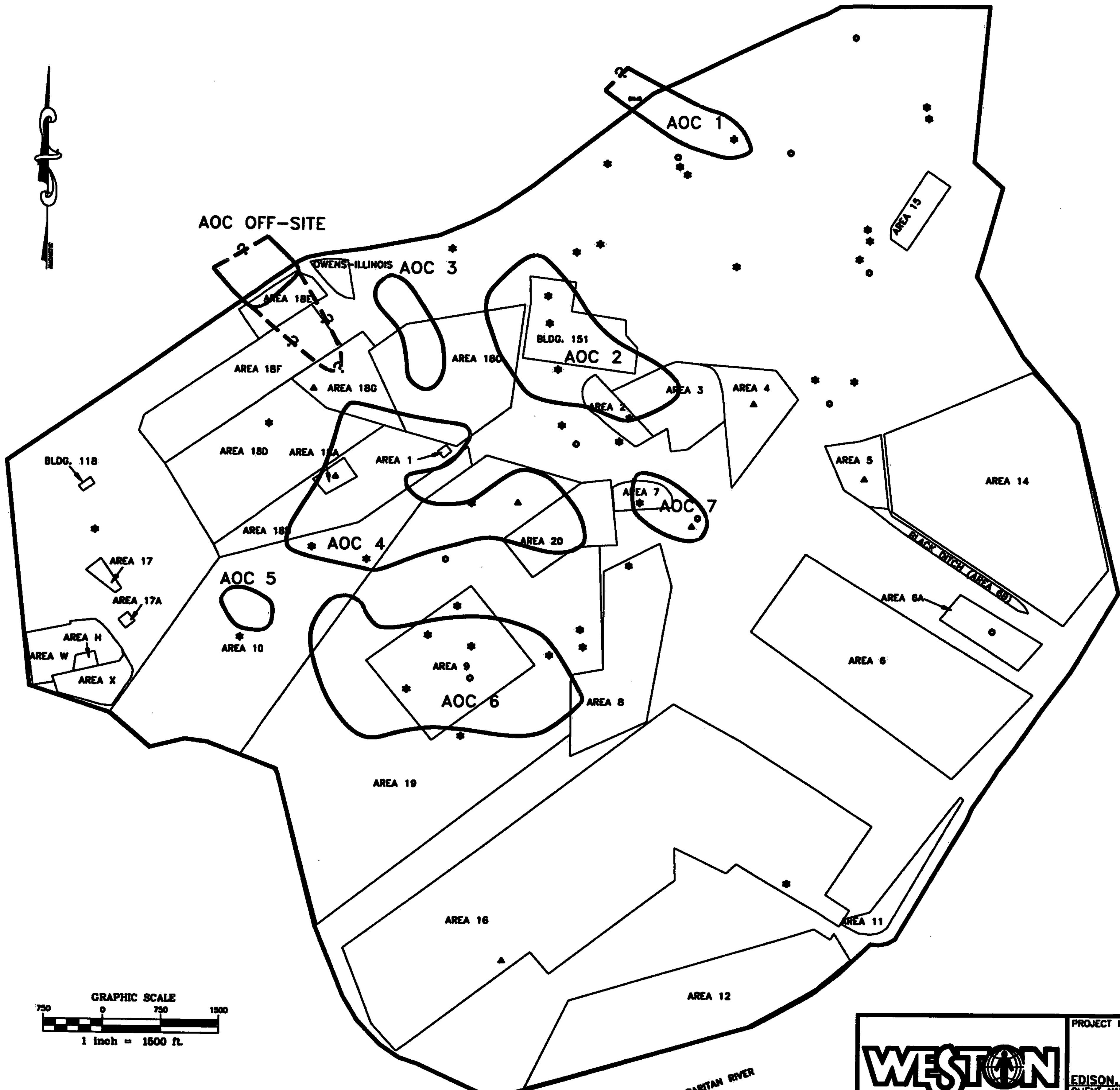
PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY

CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

ROUND 2 NICKEL GROUNDWATER SAMPLING RESULTS

DATE: JUNE 1995

FIGURE #: 5-31



AREAS OF CONCERN

AOC 1	OFF-SITE PLUME IN VICINITY OF RARITAN PLAZA I AND II
AOC 2	AREA 18C BUILDING 256
AOC 3	OWENS-ILLINOIS
AOC 4	THE POND AT AREA 18A
AOC 5	AREA 10 TENNIS COURT AREA
AOC 6	AREA 19
AOC 7	AREA 7
AOC OFF-SITE	NORTH OF EPA COMPLEX

LEGEND

- SITE BOUNDARY
- AREA BOUNDARY
- APPROXIMATE LOCATION OF KNOWN CONTAMINATED SITES
- APPROXIMATE LOCATION OF CERCLIS SITES
- APPROXIMATE LOCATION OF REGISTERED UNDERGROUND STORAGE TANKS
- VOC GROUNDWATER CONTAMINATION
- POSSIBLE VOC GROUNDWATER CONTAMINATION

NOTE: LOCATIONS ARE APPROXIMATE AND ARE BASED ON STREET ADDRESSES GIVEN IN APPLICABLE LISTS. LOCATIONS HAVE NOT BEEN FIELD VERIFIED AND SEVERAL LOCATIONS ARE NOT PRESENTED ON FIGURE. SEE TABLES 6-3, 6-4, & 6-5 FOR A SUMMARY OF SITES SHOWN ON THIS FIGURE.

WESTON MANAGERS DESIGNERS/CONSULTANTS

PROJECT NAME: FORMER RARITAN ARSENAL PHASE II REMEDIAL INVESTIGATION
EDISON, NEW JERSEY
CLIENT NAME: U.S. ARMY CORPS OF ENGINEERS

LOCATION OF GROUNDWATER VOC PLUMES AND NON-DOD SOURCES OF CONTAMINATION

DATE: MAY 1996
FIGURE #: 6-1

TABLE 3-1
SUMMARY OF MONITORING WELL CONSTRUCTION SPECIFICATIONS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

AREA	MONITORING WELL ID#	INSTALLED BY	NORTHING COORDINATE	EASTING COORDINATE	TOTAL WELL DEPTH (FT. BGS)	GROUND SURFACE ELEVATION (FT. MSL)	TOP OF INNER PVC CASING ELEVATION (FT. MSL)	TOP OF OUTER CASING ELEVATION (FT. MSL)	SCREEN / OPEN HOLE INTERVAL (FT. BGS)	SCREEN / OPEN HOLE INTERVAL (FT. MSL)	HYDROLOGIC UNIT MONITORED
18D	MW-1	---	610,021.262	530,005.965	---	90.385	93.585	93.900	---	---	----
9	MW-4*	OBG	---	---	18.000	14.520	---	---	3.50 thru 13.50	---	US/LS
9	MW-5*	OBG	---	---	31.000	4.970	---	---	3.0 thru 26.00	---	US/LS/WBK
19 [9]	MW-6	OBG	607,856.153	534,736.516	17.500	7.280	9.580	9.690	3.50 thru 17.50	3.78 thru -10.22	LS
19 [9]	MW-6C	RFW	607,866.003	534,742.352	72.250	8.260	9.250	10.180	47.90 thru 72.25	-39.64 thru -63.99	PAS
1	MW-7	OBG	610,257.012	533,428.468	13.500	30.124	31.394	32.617	3.50 thru 13.50	26.62 thru 16.62	LS
1	MW-8	OBG	610,322.074	533,446.463	14.000	29.396	31.403	32.518	4.00 thru 14.00	25.40 thru 15.40	LS
1	MW-9	OBG	610,322.760	533,520.181	13.500	29.061	30.908	31.868	3.50 thru 13.50	25.58 thru 15.56	LS
20 [7]	MW-10	OBG	609,776.020	535,577.810	14.000	15.196	17.146	18.056	3.00 thru 14.00	12.20 thru 1.20	MM/LS
[7]	MW-11	OBG	609,448.993	536,216.374	22.500	13.138	14.848	15.183	3.50 thru 22.50	9.64 thru -9.36	LS
7	MW-12	OBG	609,842.352	536,281.273	19.000	13.740	15.865	16.030	4.00 thru 19.00	9.74 thru -5.26	LS
[2]	MW-13	OBG	611,027.738	535,172.261	17.500	27.664	30.039	30.539	3.00 thru 17.50	24.66 thru 10.16	LS
[2/3/7]	MW-14	OBG	610,194.084	536,242.099	23.500	22.237	24.177	24.347	5.00 thru 23.50	17.24 thru -1.26	LS
3 [2]	MW-15	OBG	610,625.998	536,959.769	20.000	14.583	16.728	16.938	2.50 thru 20.00	12.08 thru -5.42	LS
6A [6B]	MW-16	OBG	607,847.071	540,771.608	58.000	10.417	12.089	12.304	24.00 thru 58.00	-13.58 thru -47.58	LS
4	MW-17	OBG	610,601.968	537,572.441	19.500	10.101	11.901	12.966	4.00 thru 19.50	6.10 thru -9.40	US/MM/LS
[4/3]	MW-18	OBG	611,550.593	537,129.564	19.500	19.255	21.515	21.870	4.00 thru 19.50	15.26 thru -0.25	LS
[4/5]	MW-19	OBG	610,523.389	537,953.421	19.600	7.037	9.452	9.707	2.60 thru 19.60	4.44 thru -12.56	LS
5	MW-20	OBG	609,894.673	539,129.130	35.000	11.823	13.593	14.333	5.00 thru 35.00	6.82 thru -23.18	LS
5	MW-21	OBG	609,853.575	538,947.777	25.000	5.686	7.146	8.036	5.00 thru 25.00	0.69 thru -19.31	LS
5	MW-22	OBG	610,421.627	538,933.300	28.000	6.122	8.057	8.542	5.00 thru 28.00	1.12 thru -21.88	LS
6A	MW-25	OBG	607,809.180	541,124.330	7.000	6.046	8.376	8.716	2.50 thru 7.00	3.55 thru -0.95	US
6A	MW-26	OBG	607,838.870	540,778.251	15.000	10.329	12.787	13.129	5.00 thru 15.00	5.33 thru -4.67	US/MM
6A	MW-27	OBG	608,148.619	540,371.040	10.000	6.527	9.059	9.127	2.50 thru 10.00	4.03 thru -3.47	US/MM
11	MW-28	OBG	604,278.168	539,346.715	7.000	5.001	7.168	7.608	2.50 thru 7.00	2.50 thru -2.00	US
11	MW-28B	RFW	604,292.771	539,367.877	59.000	4.830	6.810	7.470	44.00 thru 59.00	-39.17 thru -54.17	LS
11	MW-29	OBG	604,243.649	539,077.804	5.000	5.591	7.826	8.013	2.50 thru 5.00	3.09 thru 0.59	US
11	MW-30	OBG	604,118.963	539,240.469	5.000	4.256	6.173	6.538	2.00 thru 5.00	2.26 thru -0.74	US
1	MW-31	OBG	610,264.644	533,435.180	24.000	29.817	31.865	32.039	14.00 thru 24.00	15.82 thru 5.82	LS/WBK
[5/6/6A/6B]	MW-34	OBG	609,182.795	538,881.959	28.900	6.291	7.661	8.241	12.90 thru 28.90	-6.61 thru -22.61	LS
15	MW-35*	OBG	---	---	38.000	32.110	---	---	5.00 thru 35.00	---	US/LS/WBK
15	MW-36*	OBG	---	---	32.000	25.250	---	---	5.00 thru 30.00	---	US/LS/WBK
15	MW-37*	OBG	---	---	37.000	28.910	---	---	14.00 thru 34.00	---	US/LS/WBK
BKG [2]	MW-40	D&M	614,615.614	536,389.759	17.000	59.729	61.554	61.889	7.00 thru 17.00	52.73 thru 42.73	LS
4	MW-42A	D&M	610,634.345	537,249.438	17.000	11.022	13.707	13.907	7.00 thru 17.00	4.02 thru -5.98	LS
[2/3/4]	MW-43	D&M	609,593.857	537,045.380	17.000	12.152	13.852	14.087	7.00 thru 17.00	5.15 thru -4.85	MM/LS
6A [6]	MW-44	D&M	608,247.508	540,306.656	50.000	5.259	7.399	7.620	25.00 thru 50.00	-19.74 thru -44.74	LS
14 [6/6B]	MW-45	D&M	609,434.116	539,340.062	17.000	9.043	11.698	11.966	7.00 thru 17.00	2.04 thru -7.96	US/MM/LS

TABLE 3-1
SUMMARY OF MONITORING WELL CONSTRUCTION SPECIFICATIONS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

AREA	MONITORING WELL ID#	INSTALLED BY	NORTHING COORDINATE	EASTING COORDINATE	TOTAL WELL DEPTH (FT. BGS)	GROUND SURFACE ELEVATION (FT. MSL)	TOP OF INNER PVC CASING ELEVATION (FT. MSL)	TOP OF OUTER CASING ELEVATION (FT. MSL)	SCREEN / OPEN HOLE INTERVAL (FT. BGS)	SCREEN / OPEN HOLE INTERVAL (FT. MSL)	HYDROLOGIC UNIT MONITORED
10	MW-46A	D&M	609,395.386	532,654.621	17.000	32.071	31.556	32.071	7.00 thru 17.00	25.07 thru 15.07	MM/LS
19 [9]	MW-47A	D&M	607,400.899	532,505.601	12.000	14.690	17.020	17.240	7.00 thru 12.00	7.69 thru 2.69	LS
19 [9]	MW-47C	RFW	607,390.287	532,483.074	43.000	14.850	16.790	16.990	32.50 thru 43.00	-17.65 thru -28.15	PAS
9	MW-48A	D&M	606,768.020	533,656.866	17.000	6.790	9.410	9.635	7.00 thru 17.00	-0.21 thru -10.21	LS
9	MW-48B	D&M	606,766.261	533,653.600	28.000	6.595	7.875	8.565	19.00 thru 28.00	-12.41 thru -21.41	LS
19 [10]	MW-49	D&M	606,260.765	531,678.096	17.000	10.900	13.430	13.620	7.00 thru 17.00	3.90 thru -6.10	LS
19	MW-49C	RFW	606,267.844	531,689.976	49.000	10.380	12.450	12.750	39.00 thru 49.00	-28.62 thru -38.62	PAS
14	MW-50	D&M	609,309.891	541,340.777	12.000	10.700	13.200	13.350	7.00 thru 12.00	3.70 thru -1.30	US/MM
14	MW-50B	RFW	609,318.621	541,350.927	50.300	10.720	12.490	12.850	35.30 thru 50.30	-24.58 thru -39.58	LS
14	MW-50C	RFW	609,295.020	541,342.752	103.300	10.690	12.900	13.900	79.00 thru 103.30	-68.31 thru -92.61	PAL
16	MW-51	D&M	603,319.706	534,115.649	17.000	6.307	8.767	9.082	7.00 thru 17.00	-0.69 thru -10.69	MM/LS
16	MW-52A	D&M	604,006.083	535,006.622	12.000	7.717	10.282	10.537	7.00 thru 12.00	0.72 thru -4.28	US/MM
16	MW-52B	D&M	604,008.870	535,009.267	26.500	7.717	9.557	9.762	16.50 thru 26.50	-8.78 thru -18.78	LS
16	MW-53	D&M	604,796.672	536,465.161	12.000	6.279	7.729	7.949	7.00 thru 12.00	-0.72 thru -5.72	US/MM
[16/19]	MW-54	D&M	606,255.331	534,898.794	17.000	4.074	6.644	6.899	7.00 thru 17.00	-2.93 thru -12.93	MM/LS
17	MW-55A	D&M	607,763.814	529,880.100	9.000	47.955	50.565	50.850	7.00 thru 9.00	40.96 thru 38.96	LS
17	MW-55B	D&M	607,766.026	529,883.728	21.000	47.730	49.475	50.060	14.00 thru 21.00	33.73 thru 26.73	LS
10	MW-56	D&M	607,199.614	531,154.089	10.000	22.871	24.631	24.991	7.00 thru 10.00	15.87 thru 12.87	LS
10	MW-57	D&M	608,911.663	531,257.043	14.000	44.128	47.128	47.258	9.00 thru 14.00	35.13 thru 30.13	LS
3 [2]	MW-58	D&M	610,987.877	535,825.480	17.000	23.752	26.352	26.492	7.05 thru 17.00	16.70 thru 6.75	US/LS
7	MW-59	D&M	609,576.264	536,130.847	17.000	12.120	13.840	14.300	7.00 thru 17.00	5.12 thru -4.88	LS
7	MW-59C	RFW	609,590.594	536,143.990	78.000	12.335	12.044	12.335	64.00 thru 78.00	-51.67 thru -65.67	PAS
12	MW-60	D&M	602,390.858	536,445.216	17.000	7.004	8.694	8.864	7.00 thru 17.00	0.00 thru -10.00	MM
12	MW-60B	RFW	602,397.216	536,452.353	45.200	7.100	8.860	9.040	30.20 thru 45.20	-23.10 thru -38.10	LS
12	MW-60C	RFW	602,389.634	536,439.016	82.000	6.930	8.330	9.200	57.00 thru 82.00	-50.07 thru -75.07	PAL
[4/6/7]	MW-61	D&M	608,850.616	536,995.570	17.000	11.527	12.787	13.342	7.00 thru 17.00	4.53 thru -5.47	US/MM/LS
6	MW-62	D&M	606,246.870	539,710.296	58.000	10.392	12.447	12.577	38.00 thru 58.00	-27.61 thru -47.61	LS
[12]	MW-63	D&M	603,761.548	538,948.384	55.500	6.649	9.252	9.634	40.50 thru 55.50	-33.85 thru -48.85	LS
[12]	MW-63A	RFW	603,754.158	538,953.574	16.000	7.170	9.150	9.620	6.00 thru 16.00	1.17 thru -8.83	US
18D [1]	MW-64	D&M	610,050.406	531,280.663	23.000	64.715	66.170	66.420	13.00 thru 23.00	51.72 thru 41.72	LS
5	MW-65	Lowe	609,793.154	538,689.494	13.500	8.064	10.271	10.261	3.50 thru 13.50	4.56 thru -5.44	US/MM/LS
5	MW-66	Lowe	609,787.747	538,688.563	30.000	7.771	10.161	10.226	20.00 thru 30.00	-12.23 thru -22.23	LS
5	MW-67	Lowe	609,676.261	538,857.693	12.000	8.084	10.304	10.259	2.00 thru 12.00	6.08 thru -3.92	US/MM/LS
Bldg. 118	MW-68A	RFW	609,827.818	528,839.069	36.500	82.270	82.230	82.270	26.50 thru 36.50	55.77 thru 45.77	LS
10	MW-69A	RFW	607,212.625	529,531.311	8.000	41.650	44.210	44.620	5.00 thru 8.00	36.65 thru 33.65	LS

TABLE 3-1
SUMMARY OF MONITORING WELL CONSTRUCTION SPECIFICATIONS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

AREA	MONITORING WELL ID#	INSTALLED BY	NORTHING COORDINATE	EASTING COORDINATE	TOTAL WELL DEPTH (FT. BGS)	GROUND SURFACE ELEVATION (FT. MSL)	TOP OF INNER PVC CASING ELEVATION (FT. MSL)	TOP OF OUTER CASING ELEVATION (FT. MSL)	SCREEN / OPEN HOLE INTERVAL (FT. BGS)	SCREEN / OPEN HOLE INTERVAL (FT. MSL)	HYDROLOGIC UNIT MONITORED
10	MW-70A	RFW	606,805.464	531,794.552	19.500	19.680	22.140	22.580	9.50 thru 19.50	10.18 thru 0.18	LS
18A	MW-71C	RFW	609,862.256	532,203.046	107.000	50.970	53.520	53.810	82.50 thru 107.00	-31.53 thru -56.03	PAS
17	MW-72A	RFW	607,771.238	529,575.759	22.000	59.180	58.860	59.180	7.00 thru 22.00	52.18 thru 37.18	LS
17	MW-73A	RFW	608,075.190	529,029.343	42.000	76.750	76.450	76.750	32.00 thru 42.00	44.75 thru 34.75	LS
17	MW-74B (BKG)	RFW	608,675.402	528,566.892	68.000	100.970	100.740	100.970	64.00 thru 68.00	36.97 thru 32.97	LS
17	MW-74C (BKG)	RFW	608,678.467	528,573.022	116.000	100.860	100.520	100.860	95.00 thru 116.00	5.86 thru -15.14	PAS
[4]	MW-75A	RFW	610,884.219	538,085.796	17.500	11.700	11.350	11.700	7.50 thru 17.50	4.20 thru -5.80	US/LS
[4]	MW-75C	RFW	610,873.103	538,084.391	65.000	11.690	11.260	11.690	55.00 thru 65.00	-43.31 thru -53.31	PAS
4	MW-76A	RFW	610,185.457	537,446.500	13.500	11.630	13.840	14.430	6.50 thru 13.50	5.13 thru -1.87	US
4	MW-76B	RFW	610,196.664	537,442.939	26.000	11.810	14.240	14.460	16.00 thru 26.00	-4.19 thru -14.19	LS
4	MW-76C	RFW	610,200.886	537,449.754	58.000	12.070	14.430	14.860	48.00 thru 58.00	-35.93 thru -45.93	PAS
14	MW-77A	RFW	610,910.027	540,657.004	29.500	20.100	21.780	22.000	19.50 thru 29.50	0.60 thru -9.40	MM/LS
14	MW-77B	RFW	610,905.104	540,657.984	50.000	20.080	22.740	22.970	40.00 thru 50.00	-19.92 thru -29.92	LS
14	MW-78A	RFW	610,880.267	540,261.008	25.900	13.710	15.230	15.940	15.90 thru 25.90	-2.19 thru -12.19	LS
8	MW-79B (1)	RFW	608,045.012	536,112.813	28.000	10.700	13.040	13.240	18.00 thru 28.00	-7.30 thru -17.30	LS
8	MW-79C (1)	RFW	608,058.264	536,109.796	63.000	10.130	12.540	12.910	48.00 thru 63.00	-37.87 thru -52.87	PAS
19	MW-80A	RFW	606,938.880	534,246.355	22.000	12.240	14.220	14.360	12.00 thru 22.00	0.24 thru -9.76	LS
151	MW-81A	RFW	611,371.557	535,858.267	16.000	25.770	27.770	27.860	6.00 thru 16.00	19.77 thru 9.77	LS
OWENS	MW-82A	RFW	612,491.840	532,279.507	26.000	77.480	79.370	79.460	16.00 thru 26.00	61.48 thru 51.48	LS
15	MW-83A	RFW	613,727.284	539,716.448	16.000	26.330	28.040	28.400	6.00 thru 16.00	20.33 thru 10.33	LS
[15]	MW-84A	RFW	613,375.350	539,729.378	21.000	25.730	28.670	28.500	11.00 thru 21.00	14.73 thru 4.73	LS
[15]	MW-85A	RFW	613,466.033	539,895.475	28.000	21.550	23.430	23.840	18.00 thru 28.00	3.55 thru -6.45	LS
[15]	MW-86A	RFW	612,825.129	540,408.490	18.000	15.790	17.690	18.080	8.00 thru 18.00	7.79 thru -2.21	LS
[15]	MW-86C	RFW	612,848.358	540,345.838	93.330	15.730	17.560	17.960	68.33 thru 93.33	-52.60 thru -77.60	PAS
18D[1]	MW-87A	RFW	610,713.290	532,295.481	30.000	71.640	73.610	73.580	20.00 thru 30.00	51.64 thru 41.64	LS
18D[1]	MW-87C	RFW	610,725.794	532,287.816	84.000	72.070	73.960	74.190	74.00 thru 84.00	-1.93 thru -11.93	PAS
18C[1]	MW-88A	RFW	611,158.671	533,311.953	21.000	58.040	60.260	60.100	11.00 thru 21.00	47.04 thru 37.04	LS
18C[1]	MW-88C	RFW	611,165.004	533,303.388	99.000	58.810	60.620	60.780	89.00 thru 99.00	-30.19 thru -40.19	PAS
10	MW-89A	RFW	610,158.504	533,668.544	12.000	25.250	26.890	27.150	6.00 thru 12.00	19.25 thru 13.25	US/MM/LS
10	MW-89C	RFW	610,151.799	533,660.887	69.600	25.580	27.060	27.370	59.00 thru 69.60	-33.42 thru -44.02	PAS
16	MW-90A	RFW	604,744.356	533,735.965	18.000	5.880	7.650	7.500	13.00 thru 18.00	-7.12 thru -12.12	LS
16	MW-90B	RFW	604,740.906	533,738.371	28.000	5.940	7.690	7.780	18.00 thru 28.00	-12.06 thru -22.06	LS
16	MW-90C	RFW	604,754.258	533,734.462	88.000	5.430	7.510	7.960	62.50 thru 88.00	-57.07 thru -82.57	PAS
16	MW-91A	RFW	602,577.368	533,136.024	25.000	5.240	7.140	6.980	15.00 thru 25.00	-9.76 thru -19.76	LS
16	MW-91B	RFW	602,574.862	533,131.233	45.000	5.130	6.830	6.680	30.00 thru 45.00	-24.87 thru -39.87	LS
16	MW-92B	RFW	605,645.575	535,633.647	28.000	4.860	6.580	6.580	18.00 thru 28.00	-13.14 thru -23.14	LS
16	MW-93A	RFW	605,509.471	537,528.094	26.000	5.780	7.470	7.310	16.00 thru 26.00	-10.22 thru -20.22	LS
16	MW-93B	RFW	605,507.918	537,530.899	43.000	5.600	7.290	7.320	28.00 thru 43.00	-22.40 thru -37.40	LS

TABLE 3-1
SUMMARY OF MONITORING WELL CONSTRUCTION SPECIFICATIONS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

AREA	MONITORING WELL ID#	INSTALLED BY	NORTHING COORDINATE	EASTING COORDINATE	TOTAL WELL DEPTH (FT. BGS)	GROUND SURFACE ELEVATION (FT. MSL)	TOP OF INNER PVC CASING ELEVATION (FT. MSL)	TOP OF OUTER CASING ELEVATION (FT. MSL)	SCREEN / OPEN HOLE INTERVAL (FT. BGS)	SCREEN / OPEN HOLE INTERVAL (FT. MSL)	HYDROLOGIC UNIT MONITORED
6	MW-94A	RFW	608,094.484	538,792.763	15.000	3.690	5.930	6.390	5.00 thru 15.00	-1.31 thru -11.31	MM/LS
6	MW-95A	RFW	607,470.436	539,412.042	15.000	2.210	4.190	4.810	5.00 thru 15.00	-2.79 thru -12.79	MM
6	MW-96A	RFW	607,225.624	540,744.349	56.000	5.630	7.220	7.120	42.00 thru 56.00	-36.37 thru -50.37	LS
6	MW-96C	RFW	607,202.219	540,737.455	82.700	5.780	7.650	8.000	72.70 thru 82.70	-66.92 thru -76.92	PAL
6	MW-97A	RFW	607,504.227	540,344.234	35.000	5.970	7.920	8.360	20.00 thru 35.00	-14.03 thru -29.03	LS
6	MW-97B	RFW	607,501.746	540,336.237	55.000	6.569	8.890	8.820	40.00 thru 55.00	-33.43 thru -48.43	LS
14	MW-98A	RFW	608,908.507	540,163.896	33.000	7.290	8.900	8.890	18.00 thru 33.00	-10.71 thru -25.71	LS
14	MW-98B	RFW	608,909.668	540,171.189	52.000	6.730	8.680	8.680	37.00 thru 52.00	-30.27 thru -45.27	LS
[6B]	MW-99A	RFW	608,722.795	539,552.138	25.000	7.250	9.520	9.580	15.00 thru 25.00	-7.75 thru -17.75	LS
[6B]	MW-99B	RFW	608,717.423	539,557.058	39.600	7.300	9.980	9.950	29.60 thru 39.60	-22.30 thru -32.30	LS
11	MW-100A	RFW	605,472.848	539,993.231	10.000	8.060	9.660	10.760	5.00 thru 10.00	3.06 thru -1.94	US
[11/16]	MW-101A	RFW	605,331.405	539,221.660	34.000	7.310	9.060	9.270	24.00 thru 34.00	-16.69 thru -26.69	LS
BKG	MW-103A (BKG)	RFW	615,026.355	535,973.473	30.000	81.000	82.960	82.910	23.00 thru 30.00	58.00 thru 51.00	LS
BKG	MW-103C (BKG)	RFW	615,032.144	535,987.248	94.000	80.770	82.960	83.520	84.00 thru 94.00	-3.23 thru -13.23	PAS
BKG	MW-104A (BKG)	RFW	613,749.973	533,280.724	40.000	89.350	89.030	89.350	31.50 thru 40.00	57.85 thru 49.35	LS
BKG	MW-104C (BKG)	RFW	613,755.714	533,278.200	92.000	89.200	88.810	89.200	67.00 thru 92.00	22.20 thru -2.80	PAS
BKG	MW-105A (BKG)	RFW	612,325.374	530,881.733	46.000	92.840	92.500	92.840	36.00 thru 46.00	56.84 thru 46.84	LS
BKG	MW-105C (BKG)	RFW	612,329.834	530,891.187	125.500	92.660	92.660	92.920	105.50 thru 125.50	-12.84 thru -32.84	PAS
18B	MW-EPA-1A	EPA	609,597.702	531,754.838	---	47.853	49.803	49.983	---	---	---
18A	MW-EPA-2A	EPA	609,944.553	532,209.388	---	51.760	53.315	53.880	---	---	---
18D	MW-EPA-3A	EPA	610,950.378	531,145.886	---	89.155	91.450	91.600	---	---	---
18C	MW-EPA-4A	EPA	611,687.401	532,922.752	---	69.912	71.557	71.872	---	---	---
18C	MW-EPA-5A	EPA	611,997.959	533,438.809	---	62.429	64.289	64.784	---	---	---
18G	MW-EPA-6A	EPA	611,770.489	532,343.776	---	78.763	78.433	78.763	---	---	---
18G	MW-EPA-7A	EPA	611,793.715	532,419.347	---	78.508	78.108	78.508	---	---	---
18E	MW-EPA-8A	EPA	612,038.027	530,781.563	---	94.593	97.098	97.583	---	---	---
Bldg. 151	MW-SA4	Summit	612,452.508	534,637.423	---	53.369	56.074	56.329	---	---	---
Bldg. 151	MW-SA5	Summit	611,667.446	535,049.983	---	37.556	39.426	40.016	---	---	---
Bldg. 151	MW-SPCI4	Salwen Co.	611,876.990	534,701.521	---	41.858	43.748	44.513	---	---	---

TABLE 3-1
SUMMARY OF MONITORING WELL CONSTRUCTION SPECIFICATIONS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

AREA	MONITORING WELL ID#	INSTALLED BY	NORTHING COORDINATE	EASTING COORDINATE	TOTAL WELL DEPTH (FT. BGS)	GROUND SURFACE ELEVATION (FT. MSL)	TOP OF INNER PVC CASING ELEVATION (FT. MSL)	TOP OF OUTER CASING ELEVATION (FT. MSL)	SCREEN / OPEN HOLE INTERVAL (FT. BGS)	SCREEN / OPEN HOLE INTERVAL (FT. MSL)	HYDROLOGIC UNIT MONITORED
8	OB-01B (2)	RFW	608,045.533	536,097.060	28.000	10.280	12.040	12.040	18.00 thru 28.00	-7.72 thru -17.72	LS
8	OB-02B (2)	RFW	608,041.820	536,082.541	28.000	10.510	12.090	12.050	18.00 thru 28.00	-7.49 thru -17.49	LS
8	OB-03B (2)	RFW	608,028.406	536,116.164	29.000	11.670	12.950	13.650	19.00 thru 29.00	-7.33 thru -17.33	LS
8	OB-04B (2)	RFW	608,074.303	536,106.837	27.000	9.110	11.180	11.320	17.00 thru 27.00	-7.89 thru -17.89	LS
8	OB-05A (2)	RFW	608,051.894	536,111.621	9.500	10.420	12.370	12.950	4.50 thru 9.50	5.92 thru 0.92	US

Notes:

OBG - O'Brien & Gere
D&M - Dames & Moore
RFW - Roy F. Weston
MSL - Mean Sea Level
---- Data Not Available
BGS - Below Ground Surface
BKG - Background
LS - Lower Sand
US - Upper Sand
MM - Meadowmat
PAL - Palisades Formation (Bedrock)
PAS - Passaic Formation (Bedrock)
WBK - Weathered Bedrock Group (Raritan Fire Clay, Weathered Passaic and Saprolite Units).

Lowe - Lowe Environmental Services
(1) Monitoring Well constructed as pumping well for proposed hydraulic conductivity testing.
(2) Observation well for proposed hydraulic conductivity testing.
Area designations denote the actual location of the monitoring well.
Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Northing and Easting data are reported in 1983 North American Datum (NAD 83) coordinates.
[ ] - indicates the area(s) the wells are adjacent to or associated with, since they are not within area boundaries. The well could be located upgradient, downgradient or sidegradient to the area indicated. For the position of the monitoring well in relation to the area see Figure 1-2. These wells were assigned to area by Dames & Moore or Roy F. Weston.
* Well has not been located and is assumed destroyed.

TABLE 3-2
SUMMARY OF PROPOSED VERSUS INSTALLED MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

ACTUAL MONITORING WELL I.D.	AREA*	PROPOSED MONITORING WELL I.D.	COMMENTS
MW-6C	9	PW-6C	Bedrock Well
MW-28B	11	PW-28B	Overburden Well
MW-47C	9	PW-47C	Bedrock Well
MW-49C	19	PW-49C	Bedrock Well
MW-50B	14	PW-50B	Overburden Well
MW-50C	14	PW-50C	Bedrock Well
MW-59C	7	PW-59C	Bedrock Well
MW-60B	12	PW-60B	Overburden Well
MW-60C	12	PW-60C	Bedrock Well
MW-63A	12	PW-63A	Overburden Well
MW-68A	11B	PW-7	Overburden Well
MW-69A	X,H,W	PW-6	Overburden Well
MW-70A	10	PW-5	Overburden Well
MW-71C	18A	PW-11C	Bedrock Well
MW-72A	17	PW-3	Overburden Well
MW-73A	17	PW-2	Overburden Well
MW-74B	17	PW-1A	Overburden Background Well
MW-74C	17	PW-1B	Bedrock Background Well
MW-75A	4	PW-12A	Overburden Well
MW-75C	4	PW-12C	Bedrock Well
MW-76A	4	PW-13A	Overburden Well
MW-76B	4	PW-13B	Overburden Well
MW-76C	4	PW-13C	Bedrock Well
MW-77A	14	PW-36A	Overburden Well
MW-77B	14	PW-36B	Overburden Well
MW-78A	14	PW-35A	Overburden Well
MW-79A	8	PW-16A	Proposed Pumping Well, Not Drilled
MW-79B	8	PW-16B	Overburden Monitoring/Pumping Well
MW-79C	8	PW-16C	Bedrock Monitoring/Pumping Well
MW-80A	9	PW-40A	Replacement Well for MW-5, Overburden Well
MW-81A	Bldg. 151	NA	Replacement for MW-SA2, Overburden Well
MW-82A	Owens-Illinois	PW-8A	Overburden Well
MW-83A	15	NA	Replacement for MW-35, Overburden Well
MW-84A	15	NA	Replacement for MW-36, Overburden Well
MW-85A	15	NA	Replacement for MW-37, Overburden Well
MW-86A	15	PW-37A	Overburden Well
MW-86C	15	PW-37C	Bedrock Well
MW-87A	18D	PW-7A	Overburden Well
MW-87C	18D	PW-7C	Bedrock Well
MW-88A	18C	PW-9A	Overburden Well
MW-88C	18C	PW-9C	Bedrock Well
MW-89A	1	PW-10A	Overburden Well
MW-89C	1	PW-10C	Bedrock Well
MW-90A	16	PW-20A	Overburden Well
MW-90B	16	PW-20B	Overburden Well
MW-90C	16	PW-20C	Bedrock Well
MW-91A	16	PW-21A	Overburden Well
MW-91B	16	PW-21B	Overburden Well
MW-92A	16	PW-22A	Proposed Overburden Well, Not Drilled
MW-92B	16	PW-22B	Overburden Well

Notes:

NA - Not Assigned
PW - Proposed Well
MW - Monitoring Well
ST. M.M. - St. Margaret Mary Church
*: These area designations reflect only the physical location of construction as stated in the July and December 1993 Work Plans. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 3-2
SUMMARY OF PROPOSED VERSUS INSTALLED MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

ACTUAL MONITORING WELL I.D.	AREA*	PROPOSED MONITORING WELL I.D.	COMMENTS
MW-93A	16	PW-24A	Overburden Well
MW-93B	16	PW-24B	Overburden Well
MW-94A	6	PW-30A	Overburden Well
MW-95A	6	PW-29A	Overburden Well
MW-96A	6	PW-27A	Overburden Well
MW-96B	6	PW-27B	Proposed Overburden Well, Not Drilled
MW-96C	6	PW-27C	Bedrock Well
MW-97A	6A	PW-28A	Overburden Well
MW-97B	6A	NA	Overburden Well Added to Phase II RI
MW-98A	6B	PW-31A	Overburden Well
MW-98B	6B	PW-31B	Overburden Well
MW-99A	6B	PW-32A	Overburden Well
MW-99B	6B	PW-32B	Overburden Well
MW-100A	11	PW-26A	Overburden Well
MW-101A	11	PW-25A	Overburden Well
MW-102A	12	PW-23A	Will be Drilled in Future
MW-102B	12	PW-23B	Will be Drilled in Future
MW-103A	N.Y. Times	PW-15A	Overburden Background Well
MW-103C	N.Y. Times	PW-15C	Bedrock Background Well
MW-104A	Edison Park	PW-14A	Overburden Background Well
MW-104C	Edison Park	PW-14C	Bedrock Background Well
MW-105A	St. M.M. Church	PW-39A	Overburden Background Well
MW-105C	St. M.M. Church	PW-39C	Bedrock Background Well
MW-106A	18C	PW-41A	Will be Drilled in Future
MW-107A	18C	PW-42A	Will be Drilled in Future
OB-01B	8	NA	Overburden Observation Well
OB-02B	8	NA	Overburden Observation Well
OB-03B	8	NA	Overburden Observation Well
OB-04B	8	NA	Overburden Observation Well
OB-05A	8	NA	Overburden Observation Well
OB-05C	8	NA	Proposed Observation Well, Not Drilled
OB-06C	8	NA	Proposed Observation Well, Not Drilled
OB-08A	8	NA	Proposed Observation Well, Not Drilled
OB-09	9	NA	Proposed Observation Well, Not Drilled
OB-10	9	NA	Proposed Observation Well, Not Drilled
OB-11	9	NA	Proposed Observation Well, Not Drilled
OB-12	9	NA	Proposed Observation Well, Not Drilled
NA	17	PW-4	Proposed Overburden Well, Not Drilled

Notes:

NA - Not Assigned
PW - Proposed Well
MW - Monitoring Well
ST. M.M. - St. Margaret Mary Church
*: These area designations reflect only the physical location of construction as stated in the July and December 1993 Work Plans. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 3-3
SUMMARY OF MONITORING WELL DEVELOPMENT
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Monitoring Well ID	Date Development Completed	Volume of Water in well (Gallons)	Total Number of Well Volumes Pumped	Total Hours Developed (Hours)	Total Gallons Pumped	Final pH (S.U.)	Final Specific Conductivity [us/cm]	Final Temp. [Celcius]	Final Turbidity [NTU's]	Salinity [ppt]	Estimated Well Yield [gpm]	Field Observations
MW-6C	17-Oct-94	42.80	9.2	4.0	392.0	7.0	280	13.5	5.5	0.0	>0.50	—
MW-28B	29-Sep-94	9.30	68.0	4.0	637.5	7.0	19000	15.0	4.0	NM	3.50	—
MW-47C	14-Oct-94	23.00	35.0	4.0	805.0	6.0	160	16.0	6.3	0.0	6.00	—
MW-49C	13-Oct-94	29.40	12.4	4.0	365.0	7.0	250	15.0	16.5	0.0	2.50	—
MW-50B	21-Sep-94	6.74	157.0	4.0	1056.0	6.0	2050	16.0	24.0	1.5	4.20	—
MW-50C	21-Sep-94	63.41	14.6	4.0	928.0	6.6	1000	16.5	3.5	NM	4.10	—
MW-59C	27-Sep-94	46.87	25.0	4.0	1173.0	7.0	200	17.0	2.5	NM	4.50	—
MW-60B	3-Oct-94	7.00	114.0	4.0	800.0	7.0	10000	14.0	12.8	NM	5.00	—
MW-60C	3-Oct-94	49.30	6.0	4.0	301.0	9.0	6000	19.0	32.0	NM	<0.50	Green Color
MW-63A	29-Sep-94	2.03	103.0	4.0	210.0	6.5	1500	19.0	45.0	NM	0.65	—
MW-68A	31-May-94	18.80	9.3	3.0	175.0	7.1	280	13.0	15.3	NM	1.25	—
MW-69A*	2-Jun-94	0.70	38.6	Bailed*	27.0	6.9	245	14.0	OS**	NM	<0.5	—
MW-70A	26-May-94	1.90	659.0	4.0	1253.0	6.1	120	11.0	5.1	NM	>10.00	—
MW-71C	1-Jun-94	43.90	5.5	3.0	240.0	6.3	319	14.0	27.0	NM	0.50	—
MW-72A	8-Oct-93	1.50	240.0	6.0	360.0	6.9	470	18.0	2.6	NM	3.00	—
MW-73A	13-Oct-93	1.86	774.0	4.0	1440.0	5.4	140	14.0	3.8	NM	6.00	—
MW-74B	13-Oct-93	12.84	218.0	4.0	620.0	7.0	250	12.0	9.3	NM	5.00	—
MW-74C	7-Oct-93	40.00	8.7	12.0	348.0	7.1	149	17.0	35.2	NM	1.00	—
MW-75A	2-Jun-94	1.76	96.6	2.0	170.0	6.9	255	15.0	11.1	NM	0.50	—
MW-75C	2-Jun-94	37.30	9.8	2.0	365.5	6.2	235	16.0	14.2	NM	4.00	—
MW-76A*	2-Jun-94	1.15	19.1	Bailed*	22.0	7.1	1420	14.0	OS**	NM	<0.50	—
MW-76B	27-May-94	3.14	619.0	6.0	1943.7	7.2	405	12.0	39.7	NM	>10.00	—
MW-76C	31-May-94	33.20	27.0	2.8	896.4	7.3	258	14.0	2.2	NM	>10.00	—
MW-77A	19-Sep-94	2.63	102.0	4.3	268.0	7.0	1250	18.5	8.0	NM	1.30	—
MW-77B	20-Sep-94	5.04	219.0	>4.00	1105.0	5.5	800	21.0	40.0	NM	7.00	Slight Organic Odor
MW-78A	20-Sep-94	2.66	359.0	4.0	956.0	6.2	490	18.0	3.8	NM	3.10	—
MW-79B	13-Oct-94	27.50	32.5	4.0	895.0	7.0	350	15.0	24.0	0.1	4.50	—
MW-79C	13-Oct-94	35.40	5.3	4.0	189.0	7.0	1900	15.0	4.0	1.1	0.75	—

Notes:

OS - Off Scale
S.U. - Standard Units
NM - Not measured
ppt - Parts per thousand
gpm - gallons per minute

NTU - Nephelometric turbidity units
us/cm - microsiemens per centimeters
* - Due to very slow recharge rate sustained pumping of well was not possible. Well was bailed dry and allowed to recover in an attempt to complete development.
** - Due to very slow recharge rate, final turbidity units below 50 NTU were not possible

TABLE 3-3
SUMMARY OF MONITORING WELL DEVELOPMENT
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Monitoring Well ID	Date Development Completed	Volume of Water in well (Gallons)	Total Number of Well Volumes Pumped	Total Hours Developed (Hours)	Total Gallons Pumped	Final pH (S.U.)	Final Specific Conductivity [us/cm]	Final Temp. [Celcius]	Final Turbidity [NTU's]	Salinity [ppt]	Estimated Well Yield [gpm]	Field Observations
MW-80A	10-Oct-94	2.10	213.8	4.0	449.0	6.0	650	20.0	3.1	NM	>6.00	-----
MW-81A	29-Sep-94	1.60	34.4	4.0	55.0	6.0	110	15.0	3.4	NM	0.25	-----
MW-82A	27-Sep-94	1.60	227.0	4.0	363.0	6.5	110	20.0	17.4	NM	1.50	-----
MW-83A	26-Sep-94	2.00	607.0	4.0	1215.0	4.5	430	19.0	16.6	NM	4.00	-----
MW-84A	23-Sep-94	1.87	308.0	4.2	576.5	4.5	500	19.0	11.0	NM	5.50	-----
MW-85A	23-Sep-94	2.92	422.0	4.0	1253.0	4.5	450	18.0	6.7	NM	7.00	-----
MW-86A	22-Sep-94	1.82	142.8	4.0	300.0	5.4	500	18.0	8.4	NM	2.00	-----
MW-86C	22-Sep-94	58.40	11.7	4.0	682.5	5.8	165	15.0	1.8	NM	2.00	-----
MW-87A	16-Sep-94	1.65	560.6	4.0	925.0	6.0	1348	19.0	1.2	NM	6.20	-----
MW-87C	19-Oct-94	37.08	10.9	4.0	405.0	6.5	120	17.8	3.6	0.0	1.50	-----
MW-88A	5-Oct-94	1.50	70.0	4.5	105.0	6.0	195	17.5	47.6	NM	0.50	-----
MW-88C	6-Oct-94	51.30	5.3	4.5	270.5	10.0	600	15.0	20.0	NM	<0.30	-----
MW-89A*	28-Oct-94	1.10	53.0	Bailed*	59.0	6.0	190	15.0	OS**	0.0	<0.01	-----
MW-89C	26-Sep-94	40.31	7.6	4.0	308.0	7.0	210	17.5	4.0	NM	0.75	-----
MW-90A	7-Oct-94	2.10	77.6	4.0	163.0	6.5	5500	14.5	34.1	NM	1.00	-----
MW-90B	7-Oct-94	3.80	305.0	4.0	1160.0	7.0	11000	16.0	30.3	NM	>6.00	Soapy Purge Water
MW-90C***	31-Oct-94	44.20	2.5*	2.5	110.0	7.5	3450	18.5	OS**	2.5	<0.20	-----
MW-91A	3-Oct-94	3.73	233.2	4.0	870.0	7.0	1100	16.0	14.0	NM	4.00	-----
MW-91B	3-Oct-94	6.50	137.8	4.0	896.0	7.0	15000	19.0	2.2	NM	>4.00	-----
MW-92B	6-Oct-94	3.72	130.0	5.0	485.0	6.5	3200	15.0	32.0	NM	0.80	-----
MW-93A	28-Sep-94	3.30	304.0	4.0	1005.0	7.0	12500	17.0	3.6	NM	5.00	-----
MW-93B	28-Sep-94	4.83	167.6	4.0	809.5	7.0	15000	15.0	16.0	NM	4.30	-----
MW-94A	12-Oct-94	2.00	565.0	4.0	1130.0	7.0	11000	19.0	13.9	8.0	6.00	-----
MW-95A*	31-Oct-94	2.24	29.5	Bailed *	66.0	6.5	2200	13.0	OS**	4.0	<0.20	H2S Odors

Notes:

OS - Off Scale
S.U. - Standard Units
NM - Not measured
ppt - Parts per thousand
gpm - gallons per minute

NTU - Nephelometric turbidity units
us/cm - microsiemens per centimeters
* - Due to very slow recharge rate sustained pumping of well was not possible. Well was bailed dry and allowed to recover in an attempt to complete development.
** - Due to very slow recharge rate, final turbidity units below 50 NTU were not possible
*** - Based on slow recharge, open hole well was extended 15 feet and redeveloped. Recharge rate of redrilled well was also poor. Well was pumped dry and allowed to recover in an attempt to complete development. Due to very slow recovery, well could not be developed.

TABLE 3-3
SUMMARY OF MONITORING WELL DEVELOPMENT
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Monitoring Well ID	Date Development Completed	Volume of Water in well (Gallons)	Total Number of Well Volumes Pumped	Total Hours Developed (Hours)	Total Gallons Pumped	Final pH (S.U.)	Final Specific Conductivity (us/cm)	Final Temp. (Celcius)	Final Turbidity (NTU's)	Salinity (ppt)	Estimated Well Yield (gpm)	Field Observations
MW-96A	5-Oct-94	7.50	78.4	4.0	588.0	7.0	2800	17.0	45.0	NM	0.50	----
MW-96C	19-Oct-94	47.67	8.6	7.0	408.0	6.0	8000	16.4	14.4	6.0	0.50	Blue Tint
MW-97A	11-Oct-94	64.40	259.0	4.0	1140.0	7.0	10000	13.0	9.8	9.0	>6.00	Organic/Decay Odor
MW-97B	11-Oct-94	8.00	143.0	4.0	1143.0	7.0	12500	16.0	9.0	7.0	>6.00	----
MW-98A	28-Sep-94	4.50	206.0	4.0	930.0	6.3	2200	16.0	14.0	NM	5.00	----
MW-98B	28-Sep-94	7.85	86.0	4.0	675.0	7.0	1450	16.0	14.0	NM	3.50	----
MW-99A	4-Oct-94	3.20	268.0	4.0	860.0	6.5	3900	13.9	6.7	NM	5.00	----
MW-99B	4-Oct-94	5.50	172.0	4.0	946.0	7.0	9000	15.0	10.0	NM	4.00	----
MW-100A	30-Sep-94	4.03	231.0	4.0	932.0	7.0	9500	15.5	5.0	NM	3.75	----
MW-101A	30-Sep-94	0.80	70.0	4.5	56.0	7.0	2400	24.0	24.8	NM	0.25	----
MW-103A	20-Oct-94	1.53	236.0	4.0	361.3	6.0	140	16.5	5.0	0.0	3.50	----
MW-103C	31-Oct-94	46.96	8.2	8.3	385.0	9.0	300	19.0	30.0	0.0	0.06	----
MW-104A	31-Oct-94	1.84	147.0	4.5	271.0	4.5	140	16.5	5.0	0.0	>3.00	----
MW-104C	2-Nov-94	40.80	5.7	4.0	235.0	6.5	220	17.0	OS**	0.0	0.10	----
MW-105A	24-Oct-94	2.00	105.0	4.5	210.0	6.0	120	15.0	3.8	0.0	2.00	----
MW-105C	21-Oct-94	56.50	7.5	5.5	422.0	7.0	185	17.0	42.0	0.0	1.25	----
OB-01B	11-Oct-94	3.21	148.0	4.5	475.0	7.0	350	14.0	45.0	0.2	1.70	----
OB-02B	11-Oct-94	3.04	68.0	4.0	208.0	7.0	295	15.0	2.0	0.0	0.80	----
OB-03B	16-Oct-94	2.90	102.0	6.5	296.0	5.5	315	14.0	36.0	NM	0.90	----
OB-04B	12-Oct-94	2.64	240.0	4.0	635.0	6.5	285	14.5	11.0	0.0	3.75	----
OB-05A	15-Oct-94	0.65	30.0	3.8	19.5	7.0	700	20.0	32.0	0.5	<0.20	----

Notes:

OS - Off Scale
S.U. - Standard Units
NM - Not measured
ppt - Parts per thousand
gpm - gallons per minute

NTU - Nephelometric turbidity units
us/cm - microsiemens per centimeters
* - Due to very slow recharge rate sustained pumping of well was not possible. Well was bailed dry and allowed to recover in an attempt to complete development.
** - Due to very slow recharge rate, final turbidity units below 50 NTU were not possible

TABLE 3-4
SUMMARY OF SGWS SAMPLING PROGRAM
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID (1)	AREA	DATE COLLECTED	SCREENED INTERVAL	TYPE OF SCREEN	OVM READING	DEPTH TO WATER
GW-SGW-1	17	22-Apr-94	30-32'	Stainless Steel	0	25'8"
GW-SGW-2	17	22-Apr-94	20-22	Stainless Steel	0	10'9"
GW-SGW-3	18F	22-Apr-94	27-29'	Stainless Steel	0	22'
GW-SGW-4	[18E]	25-Apr-94	38-40'	Stainless Steel	0	35'8"
GW-SGW-5	18E	25-Apr-94	37-39'	Stainless Steel	0	29'6"
GW-SGW-6	BKG	26-Apr-94	43-45'	Stainless Steel	0	25'5"
GW-SGW-7	18D	19-May-94	48-50'	Stainless Steel	0	39'8"
GW-SGW-8	OI	26-Apr-94	30-32'	Stainless Steel	0	19'3"
GW-SGW-9	18D	25-Apr-94	34-36'	Stainless Steel	0	32'6"
GW-SGW-10	18F	25-Apr-94	43-45'	Stainless Steel	0	No Sample
GW-SGW-11	18G	26-Apr-94	42-44'	Stainless Steel	0	31'1"
GW-SGW-12	OI	26-Apr-94	32-34'	Stainless Steel	0	30'6"
GW-SGW-13	BKG	27-Apr-94	30-32'	Stainless Steel	0	No Sample
GW-SGW-14	BKG	15-Apr-94	3-8'	PVC	0	2'7"
GW-SGW-15	BKG	15-Apr-94	6-11'	PVC	0	10'6"
GW-SGW-16	BKG	15-Apr-94	5-10'	PVC	0	7'7"
GW-SGW-17	18D	11-Apr-94	8-13'	PVC	0	12'
GW-SGW-18	18D	11-Apr-94	0-5'	PVC	0	2'9"
GW-SGW-19	18G	11-Apr-94	10-15'	PVC	0	12'
GW-SGW-20	18C	12-Apr-94	10-15'	PVC	0	13'10"
GW-SGW-21	18C	12-Apr-94	10-15'	PVC	0	13'3"
GW-SGW-22	[B151]	3-May-94	1'9"-6'9"	PVC	0	5'3"
GW-SGW-23	BKG	18-Apr-94	7-12'	PVC	0	7'7"
GW-SGW-24	BKG	20-Apr-94	20-22'	Stainless Steel	0	No Sample
GW-SGW-25	10	18-Apr-94	5-10'	PVC	0	4'11"
GW-SGW-26	10	13-Apr-94	4'9"-9'9"	PVC	0	8'9"
GW-SGW-27 (65)	10	13-Apr-94	7'10"-12'10"	PVC	0	8'4"
GW-SGW-28 (66)	10	13-Apr-94	4'10"-9'10"	PVC	0	5'10"
GW-SGW-29 (93)	[19]	13-Apr-94	6-11'	PVC	0	4'9"
GW-SGW-30	[18C]	20-Apr-94	13'3"-18'3"	PVC	0	12'1"
GW-SGW-31	B151	15-Apr-94	5-10'	PVC	0	6'6"
GW-SGW-32	10	18-Apr-94	0-5'	PVC	0	6"
GW-SGW-33	19	13-Apr-94	9.5-14.5'	PVC	0	11'3"
GW-SGW-34	19	12-Apr-94	18-20'	Stainless Steel	0	8'6"
GW-SGW-35	19	13-Apr-94	5.5-10.5'	PVC	0	8'
GW-SGW-36	19	12-Apr-94	8-10'	Stainless Steel	0	5'5"
GW-SGW-37 (67)	[02]	20-Apr-94	0-5'	PVC	0	3'10"
GW-SGW-38 (68)	03	14-Apr-94	0-5'	PVC	0	4'
GW-SGW-39	[03]	15-Apr-94	8'6"-13'6"	PVC	0	7'
GW-SGW-40	19	18-Apr-94	8'3"-13'3"	PVC	0	8'3"
GW-SGW-41	09	12-Apr-94	5-10'	PVC	0	3'10"
GW-SGW-42	09	19-Apr-94	6'5"-11'5"	PVC	0	7'5"
GW-SGW-43	19	12-Apr-94	10-15'	PVC	0	8'
GW-SGW-44	20	19-Apr-94	8'2"-13'2"	PVC	0	7'2"
GW-SGW-45 (69)	[07]	15-Apr-94	4'6"-9'6"	PVC	0	6'
GW-SGW-46 (70)	[03]	15-Apr-94	10-15'	PVC	0	11'1"
GW-SGW-47	04	18-Apr-94	6'6"-11'6"	PVC	0	8'8"
GW-SGW-48 (71)	19	18-Apr-94	5-10'	PVC	0	7'7"
GW-SGW-49	19	18-Apr-94	5-10'	PVC	0	6'9"
GW-SGW-50	09	14-Apr-94	0-5'	PVC	0	2'
GW-SGW-51	09	15-Apr-94	10-15'	PVC	0	10'7"

NOTE:

All PVC Blind Probe Samplers had 5' screened intervals.
All Stainless Steel Screen Point Samplers had 2' screened intervals.
[ ] - Indicates the area(s) the SGWS points are adjacent to or associated with, since they are not within area boundaries.
1. Number inside ( )'s indicates a second attempt was made at this location to collect a water sample from a deeper interval.

TABLE 3-4
SUMMARY OF SGWS SAMPLING PROGRAM
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID (1)	AREA	DATE COLLECTED	SCREENED INTERVAL	TYPE OF SCREEN	OVM READING	DEPTH TO WATER
GW-SGW-52	19	15-Apr-94	1-6'	PVC	0	5'6"
GW-SGW-53	08	14-Apr-94	9-14'	PVC	0	9'1"
GW-SGW-54	08	14-Apr-94	2-7'	PVC	0	6'
GW-SGW-55	[06]	14-Apr-94	4-9'	PVC	0	6'2"
GW-SGW-56	[04]	22-Apr-94	5-10'	PVC	0	7'6"
GW-SGW-57	19	14-Apr-94	0-5'	PVC	0	1'
GW-SGW-58	19	14-Apr-94	3'6"-8'6"	PVC	0	4'6"
GW-SGW-59	19	14-Apr-94	1'5"-6'5"	PVC	0	2'6"
GW-SGW-60	[19]	13-Apr-94	0-4.5'	PVC	0	1.5'
GW-SGW-61	08	20-Apr-94	14'8"-19'8"	PVC	0	17'5"
GW-SGW-62	[08]	4-May-94	5-10'	PVC	0	4'
GW-SGW-63	[06]	19-Apr-94	2'6"-7'6"	PVC	0	4'6"
GW-SGW-64	[06]	15-Apr-94	9-14'	PVC	0	11'
GW-SGW-65	10	20-Apr-94	22-24'	Stainless Steel	0	No Sample
GW-SGW-66	10	20-Apr-94	24-26'	Stainless Steel	0	No Sample
GW-SGW-67	[02]	20-Apr-94	21-23'	Stainless Steel	0	No Sample
GW-SGW-68	03	20-Apr-94	15-20'	PVC	0	4'
GW-SGW-69	[07]	20-Apr-94	21-23'	Stainless Steel	0	No Sample
GW-SGW-70	[03]	20-Apr-94	22-24'	Stainless Steel	0	10'7"
GW-SGW-71	19	18-Apr-94	23-25'	Stainless Steel	0	7'7"
GW-SGW-72	[18C]	27-Apr-94	49-51'	Stainless Steel	0	33'
GW-SGW-73	18C	22-Apr-94	12-17'	PVC	0	7'4"
GW-SGW-74	18C	26-Apr-94	5-10'	PVC	0	7'6"
GW-SGW-75	18C	22-Apr-94	5-10'	PVC	0	7'6"
GW-SGW-76	01	29-Apr-94	4-9'	PVC	0	5'
GW-SGW-77	18C	4-May-94	10-15'	PVC	0	12'
GW-SGW-78	19	28-Apr-94	0-4'	PVC	0	No Sample
GW-SGW-79	[20]	28-Apr-94	10-15'	PVC	0	12'10"
GW-SGW-80	18C	26-Apr-94	35-37'	Stainless Steel	0	22'2"
GW-SGW-81	[19]	28-Apr-94	10-15'	PVC	0	11'6"
GW-SGW-82	19	27-Apr-94	4'6"-9'6"	PVC	0	8'6"
GW-SGW-83	19	27-Apr-94	9-14'	PVC	0	12'1"
GW-SGW-84	10	27-Apr-94	8'6"-13'6"	PVC	0	8'6"
GW-SGW-85	10	28-Apr-94	5-10'	PVC	0	6'7"
GW-SGW-86	10	28-Apr-94	0-5'	PVC	0	2'3"
GW-SGW-87	19	27-Apr-94	4'6"-9'6"	PVC	0	8'6"
GW-SGW-88	19	27-Apr-94	7'3"-12'3"	PVC	0	5'2"
GW-SGW-89	18C	4-May-94	2'6"-7'6"	PVC	0	4'
GW-SGW-90	18B	4-May-94	0-5'	PVC	0	2'8"
GW-SGW-91	18B	4-May-94	23-25'	Stainless Steel	0	22'2"
GW-SGW-92	18B	4-May-94	3'8"-8'8"	PVC	0	5'10"
GW-SGW-93	[19]	28-Apr-94	23-25'	Stainless Steel	0	No Sample
GW-SGW-94	18C	2-May-94	22-24'	Stainless Steel	0	18'
GW-SGW-95	[B151]	29-Apr-94	8'6"-13'6"	PVC	0	12'6"
GW-SGW-96	[B151]	29-Apr-94	9'8"-14'8"	PVC	0	9'1"
GW-SGW-97	02	29-Apr-94	7-12'	PVC	0	9'3"
GW-SGW-98	[07]	29-Apr-94	7-12'	PVC	0	9'5"
GW-SGW-99	[07]	29-Apr-94	1'11"-6'11"	PVC	0	4'
GW-SGW-100	[20]	23-May-94	10-15'	PVC	0	12'
GW-SGW-101	[07]	20-May-94	0-5'	PVC	0	6"
GW-SGW-102	[04]	29-Apr-94	21-23'	Stainless Steel	0	9'2"

NOTE:

All PVC Blind Probe Samplers had 5' screened intervals.
All Stainless Steel Screen Point Samplers had 2' screened intervals.
[ ] - Indicates the area(s) the SGWS points are adjacent to or associated with, since they are not within area boundaries.
1. Number inside ( )'s indicates a second attempt was made at this location to collect a water sample from a deeper interval.

TABLE 3-4
SUMMARY OF SGWS SAMPLING PROGRAM
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID (1)	AREA	DATE COLLECTED	SCREENED INTERVAL	TYPE OF SCREEN	OVM READING	DEPTH TO WATER
GW-SGW-103	[04]	2-May-94	0-5'	PVC	0	3'
GW-SGW-104	06	2-May-94	3'6"-8'6"	PVC	0	3'
GW-SGW-105	[06]	5-May-94	0-3'	PVC	0	No Sample
GW-SGW-106	[06]	2-May-94	0-4'	PVC	0	2'
GW-SGW-107	[06]	4-May-94	0-5'	PVC	0	2'6"
GW-SGW-108	09	29-Apr-94	6-11'	PVC	0	9'
GW-SGW-109	[09]	29-Apr-94	4'6"-9'6"	PVC	0	5'6"
GW-SGW-110	19	29-Apr-94	9-14'	PVC	0	9'5"
GW-SGW-111	10	28-Apr-94	5-10'	PVC	0	6'7"
GW-SGW-112	10	28-Apr-94	7-12'	PVC	0	11'
GW-SGW-113	19	28-Apr-94	5-10'	PVC	0	8'
GW-SGW-114	09	28-Apr-94	23-25'	Stainless Steel	0	16'
GW-SGW-115	18B	4-May-94	23-25'	Stainless Steel	0	16'
GW-SGW-116	10	3-May-94	13-18'	PVC	0	15'6"
GW-SGW-117	10	3-May-94	2'8"-7'8"	PVC	0	4'
GW-SGW-118	10	3-May-94	10-15'	PVC	0	14'6"
GW-SGW-119	10	3-May-94	4'6"-9'6"	PVC	0	8'3"
GW-SGW-120	BKG	2-May-94	23-25'	Stainless Steel	0	17'
GW-SGW-121	BKG	2-May-94	22-24'	Stainless Steel	0	21'
GW-SGW-122	BKG	2-May-94	10-15'	PVC	0	12'
GW-SGW-123	BKG	2-May-94	8-13'	PVC	0	9'
GW-SGW-124	19	3-May-94	3'8"-8'8"	PVC	0	3'10"
GW-SGW-125	19	3-May-94	4'6"-9'6"	PVC	0	6'
GW-SGW-126	15	23-May-94	19-21'	Stainless Steel	0	10'
GW-SGW-127	15	19-May-94	21-23'	Stainless Steel	0	12'11"
GW-SGW-128	15	23-May-94	5-10'	PVC	0	5'
GW-SGW-129	[15]	23-May-94	5-10'	PVC	0	8'
GW-SGW-130	19	3-May-94	5-10'	PVC	0	6'2"
GW-SGW-131	19	3-May-94	9'6"-14'6"	PVC	0	4'6"
GW-SGW-132	19	3-May-94	4'6"-9'6"	PVC	0	3'2"
GW-SGW-133	10	19-May-94	14'6"-16'6"	Stainless Steel	0	6'3"
GW-SGW-134	10	19-May-94	5-10'	PVC	0	5'
GW-SGW-135	19	23-May-94	7-12'	PVC	0	6'
GW-SGW-136	19	19-May-94	6'6"-11'6"	PVC	0	4'6"
GW-SGW-137	09	20-May-94	5-10'	PVC	0	5'6"
GW-SGW-138	09	20-May-94	2'7"-7'7"	PVC	0	5'7"
GW-SGW-139	10	20-May-94	10-15'	PVC	0	12'
GW-SGW-140	18B	19-May-94	9-14'	PVC	0	8'10"
GW-SGW-141	20	20-May-94	5-10'	PVC	0	7'
GW-SGW-142	20	20-May-94	5-10'	PVC	0	8'6"
GW-SGW-143	18C	19-May-94	23-25'	Stainless Steel	0	10'8"
GW-SGW-144	[18C]	19-May-94	40-42'	Stainless Steel	0	39'
GW-SGW-145	BKG	20-May-94	5-10'	PVC	0	8'8"
GW-SGW-146	BKG	23-May-94	0-5'	PVC	0	3'
GW-SGW-147	16	23-May-94	0-5'	PVC	0	3'
GW-SGW-148	16	23-May-94	4-9'	PVC	0	5'
GW-SGW-149	16	23-May-94	0-5'	PVC	0	3'
GW-SGW-150	[18C]	20-May-94	11-13'	Stainless Steel	0	10'6"
GW-SGW-151	[18C]	20-May-94	10-15'	PVC	0	14'6"
GW-SGW-152	[18C]	20-May-94	13-18'	PVC	0	13'

NOTE:

All PVC Blind Probe Samplers had 5' screened intervals.
All Stainless Steel Screen Point Samplers had 2' screened intervals.
[ ] - Indicates the area(s) the SGWS points are adjacent to or associated with, since they are not within area boundaries.
1. Number inside ( )'s indicates a second attempt was made at this location to collect a water sample from a deeper interval.

TABLE 3-5
SUMMARY OF MONITORING WELL PURGING
ROUND 1 AND 2 GROUNDWATER SAMPLING EVENTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLING EVENT	MONITORING WELL ID	DATE PURGED	AVERAGE PURGE RATE [GPM]	ONE WELL VOLUME [Gallons]	TOTAL PURGE VOLUME [Gallons]	NUMBER OF WELL VOLUMES PURGED	FINAL TEMP [Celcius]	FINAL PH [S.U.]	FINAL SPECIFIC CONDUCTIVITY [US/CM]	FINAL TURBIDITY [NTU]	FINAL SALINITY [ppt]	FINAL eH [mV]	FINAL DISSOLVED OXYGEN [mg/l]	COMMENTS
ROUND 1	MW-6	11/11/94	0.30	7.44	24.00	3.23	15.70	5.40	350	6.30	0.00	126	2.20	Fast Recharge
	MW-6C (2)	11/11/94	0.50	42.77	43.00	1.01	13.00	9.52	250	25.00	0.00	94	5.10	Very Slow Recharge
	MW-7 (2)	11/11/94	0.60	6.16	15.00	2.43	13.90	5.00	140	100.00	0.00	359	2.60	Slow Recharge
	MW-8	11/11/94	0.50	8.56	31.00	3.62	13.50	4.60	201	9.60	0.00	303	3.10	Very Clear, Fast Recharge
	MW-9	11/11/94	0.50	5.79	25.00	4.34	14.20	5.40	137	3.90	0.00	352	2.30	Very Clear, Fast Recharge
	MW-10	11/10/94	0.50	5.47	27.00	4.94	17.00	5.93	483	10.00	0.00	191	1.70	Very Clear, Fast Recharge
	MW-11	11/08/94	1.60	9.75	35.00	3.59	15.30	5.70	856	5.00	NA	16	1.00	Beige Tint, Fast Recharge
	MW-12	11/10/94	1.00	2.09	45.00	21.53	17.80	4.72	342	12.80	0.00	257	2.60	Fast Recharge
	MW-13	11/09/94	0.20	6.23	34.00	5.46	20.40	4.59	191	73.00	NA	278	1.70	Slow Recharge
	MW-14	11/11/94	1.20	8.05	29.00	3.60	16.90	3.59	600	0.83	0.90	300	3.20	Clear, Fast Recharge
	MW-15	11/10/94	0.50	8.45	27.50	3.25	17.30	5.51	581	1.27	0.60	5	1.60	Yellowish Color, Slight Sufur Odor
	MW-16	11/16/94	1.70	32.33	102.00	3.15	12.30	6.92	6240	2.91	6.20	-75	1.10	Yellow-Brown Color, H2S Odor
	MW-17	11/15/94	1.00	9.23	28.50	3.09	15.20	5.47	400	10.10	0.20	81	1.70	Fast Recharge
	MW-18	11/10/94	1.10	7.60	24.00	3.16	16.40	4.88	200	49.00	0.00	276	3.80	Fast Recharge
	MW-19	11/11/94	1.40	9.98	50.00	5.01	15.10	5.55	1550	14.50	1.00	188	1.60	Clear, Fast Recharge
	MW-20	11/16/94	1.60	16.58	51.00	3.08	13.50	5.77	200	15.30	0.00	126	1.40	Clear, Fast Recharge
	MW-21	11/17/94	0.50	13.97	45.00	3.24	13.10	7.00	400	5.10	0.50	127	1.80	Clear, Fast Recharge
	MW-22	11/16/94	2.00	16.33	82.00	5.02	13.90	1.40	416	1.20	0.50	97	1.60	Fast Recharge
	MW-25	11/15/94	0.60	3.71	12.00	3.23	13.80	7.24	1100	6.40	1.00	-109	1.60	Slight Sulfur Odor
	MW-26	11/16/94	0.40	5.12	22.50	4.39	14.80	7.51	559	1.64	0.30	-107	0.90	Slight Sulfur Odor
	MW-27	11/16/94	0.30	4.67	17.00	3.64	12.30	6.16	607	8.76	0.30	-1	1.20	Clear, Fast Recharge
	MW-28	11/15/94	0.50	3.90	22.00	5.64	13.90	7.50	16500	33.00	10.00	1	1.80	Clear, Slow Recharge
	MW-28B	11/15/94	0.50	8.75	30.00	3.43	14.50	7.10	17190	6.00	13.10	-12	1.10	Very Clear, Fast Recharge
	MW-29	11/15/94	0.50	1.24	20.00	16.13	13.90	7.90	12000	5.90	10.10	12	2.50	Clear
	MW-30	11/15/94	0.50	2.18	10.00	4.59	14.40	7.90	10	11.00	3.00	-7	1.40	H2S Odor, Fast Recharge
	MW-31	11/11/94	0.50	11.57	40.00	3.46	13.20	6.90	181	26.00	0.00	130	1.90	Clear, Fast Recharge
	MW-34	11/16/94	1.30	16.69	65.00	3.89	11.00	6.11	1180	0.59	1.00	101	1.20	Clear, Fast Recharge
	MW-42A	11/14/94	0.30	2.08	9.00	4.33	14.30	5.00	488	9.65	0.10	103	1.20	Slightly Cloudy, Fast Recharge
	MW-43	11/11/94	1.00	1.59	9.25	5.82	17.40	5.73	2120	3.40	2.50	87	2.40	Slight Rust Color, Slow Recharge
	MW-44	11/15/94	0.50	7.26	22.00	3.03	12.80	7.00	3400	2.40	2.60	-85	1.50	Fast Recharge
	MW-45	11/16/94	0.30	1.82	10.00	5.49	16.30	8.13	530	10.46	0.20	2	1.00	Slow Recharge
	MW-46A	11/09/94	0.70	2.25	10.00	4.45	15.10	3.81	220	18.80	NA	NA	1.70	Fast Recharge
	MW-47A	11/09/94	0.60	0.88	5.50	6.25	16.70	4.70	406	0.85	NA	66	2.20	Clear, Slow Recharge
	MW-47C (1)	11/10/94	1.50	23.30	70.00	3.00	13.20	6.53	112	0.59	NA	-43	0.90	Slight Yellow Color, Fast Recharge
	MW-47C (1)	11/17/94	1.00	23.28	97.50	4.19	11.70	5.30	130	0.70	0.10	-35	1.20	Slight Yellow Color, Fast Recharge
	MW-48A	11/11/94	1.00	1.03	15.00	14.56	17.60	4.86	307	1.20	0.00	260	1.10	Fast Recharge
	MW-48B	11/11/94	1.00	2.10	20.00	9.52	16.10	5.56	385	1.60	0.00	87	1.40	Fast Recharge
	MW-49	11/09/94	0.80	2.11	8.00	3.79	15.40	4.81	127	39.80	NA	118	1.90	Yellow Color
	MW-49C	11/09/94	1.40	29.72	82.00	3.10	13.70	7.63	210	0.68	NA	13	0.50	Fast Recharge
	MW-50 (2)	11/15/94	0.30	1.35	5.00	3.70	15.60	6.90	2140	38.40	1.50	-54	1.00	Slight H2S Odor
	MW-50B	11/15/94	4.70	6.75	50.00	7.41	13.10	7.06	2570	16.20	2.00	-39	1.20	Fast Recharge

Notes: See Page 5 of 5.

TABLE 3-5
SUMMARY OF MONITORING WELL PURGING
ROUND 1 AND 2 GROUNDWATER SAMPLING EVENTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLING EVENT	MONITORING WELL ID	DATE PURGED	AVERAGE PURGE RATE (GPM)	ONE WELL VOLUME [Gallons]	TOTAL PURGE VOLUME [Gallons]	NUMBER OF WELL VOLUMES PURGED	FINAL TEMP [Celcius]	FINAL PH [S.U.]	FINAL SPECIFIC CONDUCTIVITY [US/CM]	FINAL TURBIDITY [NTU]	FINAL SALINITY [ppt]	FINAL eH [mV]	FINAL DISSOLVED OXYGEN [mg/l]	COMMENTS
ROUND	MW-50C	11/15/94	2.40	61.57	320.00	5.20	13.40	6.78	12940	1.90	8.50	-67	1.40	Fast Recharge
1	MW-51	11/14/94	0.40	1.95	15.00	7.69	15.40	6.70	3270	15.50	2.50	-57	1.00	Fast Recharge
(CON'T)	MW-52A (2)	11/15/94	0.20	1.01	2.60	2.57	15.10	5.93	1390	170.00	1.00	-55	2.40	Very Slow Recharge
	MW-52B	11/15/94	0.30	3.18	11.50	3.62	12.30	6.62	13200	0.54	7.50	-107	0.80	Pale Yellow Color
	MW-53 (1) (2)	11/14/94	0.30	1.43	6.00	4.20	16.00	6.19	8250	12.00	0.00	-7	2.80	H2S Odor
	MW-53 (1) (2)	11/18/94	0.40	1.23	9.00	7.30	13.30	7.03	200	3.30	0.00	-27	2.00	NA
	MW-54 (2)	11/14/94	0.50	2.20	11.00	5.00	15.20	6.61	17	>200	1.80	-140	1.90	Sulfur Odor
	MW-56	11/09/94	0.15	0.70	3.20	4.57	17.00	4.90	330	46.90	NA	NA	3.10	Fast Recharge
	MW-57	11/09/94	0.30	1.33	6.00	4.51	14.50	3.85	220	4.00	NA	NA	4.60	Fast Recharge
	MW-58	11/08/94	0.30	1.68	13.00	7.74	20.40	4.23	119	3.30	NA	335	5.20	Fast Recharge
	MW-59	11/10/94	1.50	1.77	75.00	42.37	15.90	6.30	1010	10.10	0.90	-49	1.20	Fast Recharge
	MW-59C	11/10/94	2.00	45.82	170.00	3.71	13.90	9.40	152	5.53	NA	58	1.80	Very Clear
	MW-60	11/14/94	2.00	2.12	6.50	3.07	15.40	6.52	144	11.10	12.00	-63	1.40	Fast Recharge
	MW-60B	11/14/94	0.70	6.36	21.00	3.30	13.70	6.58	11300	8.00	11.50	-37	1.40	Fast Recharge
	MW-60C (2) (3)	11/17/94	0.50	49.40	56.00	1.13	13.10	10.40	6500	>200	12.00	-21	1.00	Very Slow Recharge
	MW-61	11/17/94	0.30	1.53	8.00	5.23	13.00	9.04	384	4.31	0.30	-34	1.40	Slight Yellow Color
	MW-62	11/11/94	0.70	7.30	27.00	3.70	13.40	6.11	12850	1.63	16.80	-37	2.00	Fast Recharge
	MW-63	11/15/94	0.50	7.96	24.00	3.02	13.20	7.10	17700	5.20	17.00	-131	2.20	Fast Recharge
	MW-63A	11/15/94	0.40	1.96	6.00	3.06	15.40	6.54	1300	36.10	1.00	-84	2.20	Slight Sulfur Odor
	MW-65	11/16/94	0.50	1.59	15.00	9.43	13.80	8.00	630	7.10	0.50	41	1.70	Clear, Very Fast Recharge
	MW-66	11/16/94	0.50	4.28	17.50	4.09	12.40	5.10	583	3.00	0.00	291	2.00	Clear, Very Fast Recharge
	MW-67	11/16/94	0.50	1.10	22.50	20.45	14.20	7.30	550	17.00	0.50	42	1.30	Clear, Fast Recharge
	MW-68A	11/09/94	0.50	1.33	37.50	28.20	15.10	4.50	255	26.00	NA	159	4.10	Fast Recharge
	MW-69A (2)	11/09/94	0.50	0.70	4.00	5.71	16.80	7.38	2	>200	0.10	34	4.30	Very Slow Recharge
	MW-70A	11/09/94	0.40	1.67	7.50	4.49	14.40	4.55	130	5.90	NA	NA	5.00	Fast Recharge
	MW-71C	11/10/94	1.30	59.53	180.00	3.02	13.80	6.87	355	9.00	0.00	-43	1.60	Fast Recharge
	MW-75A	11/11/94	0.50	1.70	9.00	5.29	17.90	4.35	318	7.10	NA	283	1.20	Clear, Fast Recharge
	MW-75C	11/11/94	2.90	38.20	220.00	5.76	15.40	7.53	252	2.95	NA	-41	2.00	Fast Recharge
	MW-76A (2)	11/10/94	0.50	1.04	1.10	1.06	16.30	7.27	1980	>200	1.20	-110	5.80	Slight Sulfur Odor
	MW-76B	11/11/94	0.80	2.98	15.00	5.03	13.80	5.17	425	2.60	0.00	193	1.00	Slight Sulfur Odr, Fst Recharge
	MW-76C	11/10/94	1.50	31.40	96.00	3.06	12.10	7.10	380	41.20	0.00	4	2.80	Slight Sulfur Odr, Fst Recharge
	MW-77A	11/08/94	0.60	2.09	22.50	10.77	14.30	7.87	1290	20.00	NA	127	10.80	Very Clear, Fast Recharge
	MW-77B	11/08/94	1.00	5.30	35.00	6.60	14.30	6.20	1160	24.00	NA	131	8.30	Fast Recharge
	MW-78A	11/08/94	1.00	2.66	30.00	11.28	14.90	8.16	680	42.00	NA	15	7.90	Fast Recharge
	MW-79B	11/14/94	1.10	28.25	87.00	3.08	13.40	5.97	382	3.44	0.20	26	0.80	Fast Recharge
	MW-79C (2)	11/14/94	0.50	36.09	110.00	3.05	11.90	7.04	2420	3.23	2.40	-39	1.00	Yellow Color , Slow Recharge
	MW-80A	11/14/94	0.50	2.08	17.50	8.41	18.00	6.60	590	8.71	0.50	65	1.80	Fast Recharge
	MW-81A	11/08/94	0.10	1.49	12.00	8.05	17.20	4.74	134	195.00	NA	311	NA	Fast Recharge
	MW-82A	11/08/94	0.10	1.46	13.00	8.90	17.40	4.77	8	5.20	NA	280	6.20	Fast Recharge

Notes: See Page 5 of 5.

TABLE 3-5
SUMMARY OF MONITORING WELL PURGING
ROUND 1 AND 2 GROUNDWATER SAMPLING EVENTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLING EVENT	MONITORING WELL ID	DATE PURGED	AVERAGE PURGE RATE (GPM)	ONE WELL VOLUME [Gallons]	TOTAL PURGE VOLUME [Gallons]	NUMBER OF WELL VOLUMES PURGED	FINAL TEMP [Celcius]	FINAL PH [S.U.]	FINAL SPECIFIC CONDUCTIVITY [US/CM]	FINAL TURBIDITY [NTU]	FINAL SALINITY [ppt]	FINAL eH [mV]	FINAL DISSOLVED OXYGEN [mg/l]	COMMENTS
ROUND 1 (CON'T)	MW-83A	11/08/94	0.15	1.65	10.50	6.36	15.00	5.02	500	32.10	NA	NA	3.30	Fast Recharge
	MW-84A	11/08/94	0.30	1.86	7.50	4.03	20.20	5.49	600	37.70	NA	NA	3.10	Slight Sulfur Odor
	MW-85A	11/08/94	0.40	2.94	12.00	4.08	18.60	4.42	290	38.50	NA	NA	3.40	Fast Recharge
	MW-86A	11/08/94	0.20	1.82	8.00	4.42	17.40	5.15	700	39.00	NA	NA	2.30	Fast Recharge
	MW-86C	11/08/94	3.00	57.16	185.00	3.24	13.50	7.00	10	22.00	NA	NA	1.40	Fast Recharge
	MW-87A	11/09/94	3.30	1.52	13.00	8.55	16.30	5.06	176	6.00	NA	310	4.30	Fast Recharge
	MW-87C	11/09/94	1.60	36.91	200.00	5.42	15.00	6.96	164	5.28	NA	-20	1.10	Fast Recharge
	MW-88A	11/10/94	0.20	1.42	15.00	10.56	17.00	6.30	191	13.37	0.00	1	1.40	Fast Recharge, Clear
	MW-88C (2)	11/10/94	0.50	51.60	60.00	1.16	13.30	9.04	325	57.60	0.00	-158	3.00	Slow Recharge
	MW-89A (2) (3)	11/17/94	0.90	1.00	2.75	2.75	15.20	6.17	200	>200	0.00	32	2.30	Very Slow Recharge
	MW-89C	11/17/94	1.50	40.30	121.50	3.01	13.30	7.40	200	6.73	0.00	23	2.00	Slow Recharge, Clear
	MW-90A	11/14/94	0.70	2.21	15.00	6.79	14.60	6.62	8130	7.65	NA	-98	0.80	Fast Recharge
	MW-90B	11/14/94	1.00	3.86	25.00	6.48	13.60	6.37	9870	9.12	>40	-88	1.20	Fast Recharge
	MW-90C (2) (3)	11/17/94	0.50	51.47	50.00	0.97	14.60	10.15	15900	42.00	8.20	-42	2.20	Very Slow Recharge
	MW-91A	11/15/94	0.30	3.36	11.50	3.42	13.20	6.16	17100	7.85	11.50	-76	0.10	Fast Recharge
	MW-91B	11/15/94	0.50	6.69	29.00	4.33	12.00	5.86	14500	3.50	12.00	-32	1.00	Fast Recharge
	MW-92B	11/14/94	0.50	3.75	36.00	9.60	13.60	8.20	130	15.00	7.10	3	2.00	Fast Recharge
	MW-93A	11/15/94	1.00	3.40	25.00	7.35	14.60	6.60	14180	4.00	8.00	-61	0.60	Fast Recharge
	MW-93B	11/15/94	1.40	6.03	40.00	6.63	13.30	6.30	13000	4.00	12.50	-23	1.00	Fast Recharge
	MW-94A	11/17/94	0.40	2.00	6.00	3.00	12.30	6.89	5900	8.50	9.00	-87	1.40	Fast Recharge
	MW-95A	11/17/94	0.40	2.36	8.00	3.39	14.10	6.22	5690	50.00	3.00	-105	1.20	Strong H2S Odor, Clear
	MW-96A	11/17/94	1.30	7.29	40.00	5.49	12.70	7.43	8080	26.00	5.00	-71	1.60	Fast Recharge
	MW-96C (2)	11/17/94	0.50	49.15	65.00	1.32	13.70	6.92	16840	15.00	10.00	-71	0.90	Slow Recharge, Blue Color Noted
	MW-97A	11/16/94	0.50	4.81	20.00	4.16	11.90	8.99	12100	14.00	5.80	-12	1.70	Fast Recharge
	MW-97B	11/17/94	0.50	8.18	30.00	3.67	12.10	8.40	13300	9.80	6.00	-43	2.70	Fast Recharge
	MW-98A	11/16/94	0.80	4.59	15.00	3.27	13.80	6.50	2300	28.40	1.50	-18	2.00	Fast Recharge
	MW-98B	11/16/94	1.20	7.58	24.00	3.17	12.80	6.56	1500	8.80	1.00	-17	1.30	Fast Recharge
	MW-99A	11/16/94	0.60	3.09	20.00	6.47	12.30	8.12	6550	40.00	4.00	-20	1.20	Fast Recharge
	MW-99B	11/16/94	1.40	5.40	40.00	7.41	11.60	7.75	19150	49.00	10.00	-3	1.00	Turbid, Whitish Color
	MW-100A	11/14/94	0.50	1.01	5.00	4.95	13.80	7.40	2700	>200	2.00	10	2.20	Fast Recharge, Turbid
	MW-101A	11/14/94	0.50	4.16	20.00	4.81	14.90	7.50	13900	31.00	10.20	NA	1.40	Fast Recharge
	MW-103A	11/17/94	0.40	1.54	7.00	4.55	13.70	4.30	152	17.80	0.10	162	1.80	Fast Recharge
	MW-103C (2) (3)	11/17/94	0.50	44.77	45.00	1.01	12.40	5.10	207	60.20	0.10	-14	1.40	Pink Color, Turbid, Slight Sheen
	MW-104A	11/17/95	0.50	1.81	15.00	8.29	14.10	7.60	128	8.10	0.00	375	5.40	Slow Recharge
	MW-104C (2)	11/17/96	0.50	39.91	40.00	1.00	14.70	8.90	160	9.40	0.00	69	1.50	Very Slow Recharge
	MW-105A	11/09/94	1.80	1.90	105.00	55.26	14.90	5.00	1	29.10	NA	359	4.10	Fast Recharge
	MW-105C	11/09/94	2.20	59.41	212.00	3.57	14.20	8.30	1	34.30	NA	59	1.90	Fast Recharge
	MW-EPA2A	11/10/94	0.60	5.19	30.00	5.78	15.90	6.18	140	1.20	0.00	28	1.60	Fast Recharge, Slight PHC Odor
	MW-SA4	11/08/94	1.80	3.82	35.00	9.16	17.60	5.91	181	18.00	NA	1	1.90	Fast Recharge
	MW-SA5	11/10/94	0.70	3.13	10.00	3.19	17.70	5.75	177	1.73	0.10	13	2.00	Slow Recharge
	MW-SPCl4	11/08/94	1.00	5.50	19.00	3.45	16.60	3.82	128	9.30	NA	299	1.20	Fast Recharge

Notes: See Page 5 of 5.

TABLE 3-5
SUMMARY OF MONITORING WELL PURGING
ROUND 1 AND 2 GROUNDWATER SAMPLING EVENTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLING EVENT	MONITORING WELL ID	DATE PURGED	AVERAGE PURGE RATE (GPM)	ONE WELL VOLUME [Gallons]	TOTAL PURGE VOLUME [Gallons]	NUMBER OF WELL VOLUMES PURGED	FINAL TEMP [Celcius]	FINAL PH [S.U.]	FINAL SPECIFIC CONDUCTIVITY [US/CM]	FINAL TURBIDITY [NTU]	FINAL SALINITY [ppt]	FINAL eH [mV]	FINAL DISSOLVED OXYGEN [mg/l]	COMMENTS
ROUND 2	MW-6C (2)	12/15/94	1.60	43.00	60.00	1.40	13.00	8.54	270	27.00	0.00	NA	3.10	Very Slow Recharge, PHC Odor
	MW-28B	12/14/94	1.60	8.75	45.00	5.14	12.50	7.22	19500	35.00	18.00	-111	4.60	Fast Recharge
	MW-40	12/12/94	0.80	1.58	20.00	12.66	16.00	5.80	2	15.00	0.00	266	2.00	Fast Recharge
	MW-47C	12/13/94	5.30	23.82	120.00	5.04	11.60	8.40	160	1.60	0.00	45	2.20	Fast Recharge
	MW-49C	12/14/94	1.40	30.00	60.00	2.00	12.70	11.11	270	1.00	0.00	NA	3.72	Fast Recharge
	MW-50B	12/13/94	2.00	7.00	35.00	5.00	11.90	6.30	1200	>200	2.00	NA	0.50	Fast Recharge, Very Clear
	MW-50C	12/13/94	6.00	62.04	200.00	3.22	10.80	6.10	36	8.50	11.00	NA	2.40	Fast Recharge, Very Clear
	MW-59C	12/13/94	4.40	0.65	170.00	261.54	13.50	5.00	239	0.45	0.10	23	2.20	Fast Recharge
	MW-60B	12/15/94	4.00	6.96	60.00	8.62	12.00	6.51	10000	0.81	7.90	-41	0.30	Fast Recharge, Very Clear
	MW-60C (2)	12/15/94	3.50	53.59	130.00	2.43	11.50	8.65	1195	2.86	8.40	-201	1.20	Slow Recharge
	MW-63A	12/14/94	0.50	1.97	28.00	14.21	12.20	6.70	26	48.00	1.00	-78	4.20	Fast Recharge, Turbid
	MW-65	12/15/94	2.00	1.40	30.00	21.43	13.20	4.97	481	1.08	0.50	249	1.10	Fast Recharge
	MW-66	12/15/94	2.00	3.87	60.00	15.50	12.50	5.59	360	1.69	0.40	326	1.10	Fast Recharge
	MW-67	12/15/94	0.50	1.49	6.00	4.03	11.20	5.58	10	48.00	0.00	151	1.90	Slow Recharge
	MW-68A	12/14/95	0.80	1.21	18.00	14.88	11.50	4.68	4	29.40	0.00	396	4.40	Fast Recharge
	MW-69A (2)	12/15/94	1.00	0.61	0.80	1.31	9.40	6.40	170	1.27	0.00	NA	2.20	Very Slow Recharge
	MW-70A	12/14/94	1.00	1.84	9.00	4.89	11.70	4.42	110	64.00	0.00	NA	2.50	Fast Recharge
	MW-71C	12/12/94	2.00	46.15	205.00	4.44	13.00	6.30	198	1.60	0.00	-18	2.00	Fast Recharge
	MW-75A	12/13/94	0.80	1.70	20.00	11.76	16.50	5.19	422	12.00	0.00	153	5.90	Fast Recharge
	MW-75C	12/13/94	4.60	38.53	150.00	3.89	14.50	7.15	313	6.20	0.00	-67	5.30	Fast Recharge, H2S Odor
	MW-76A (2)	12/13/94	1.00	1.27	4.00	3.15	12.00	5.70	940	118.00	3.10	-1	3.00	Very Slow Recharge
	MW-76B	12/13/94	2.00	3.09	30.00	9.71	13.50	5.00	355	0.94	0.00	99	1.10	Fast Recharge
	MW-76C	12/13/94	4.00	32.50	240.00	7.38	13.00	5.90	261	5.30	NA	75	2.00	Fast Recharge
	MW-77A	12/13/94	1.00	2.49	15.00	6.02	11.80	8.19	10	6.50	0.00	-50	2.30	Fast Recharge
	MW-77B	12/13/94	1.40	5.52	30.00	5.43	11.40	6.92	770	5.50	0.00	79	1.40	Fast Recharge
	MW-78A	12/13/94	0.90	3.06	15.00	4.90	14.90	8.21	340	0.80	0.00	-51	2.60	Fast Recharge
	MW-79B	12/14/94	2.00	28.50	86.00	3.02	12.60	11.18	510	3.00	0.30	NA	1.30	Fast Recharge
	MW-79C (2)	12/14/94	1.00	37.00	82.00	2.22	12.00	10.70	2790	39.00	3.10	NA	0.50	Very Slow Recharge
	MW-80A	12/14/94	2.00	2.18	50.00	22.94	13.70	4.43	718	2.69	0.50	367	1.50	Fast Recharge
	MW-82A	12/12/94	0.50	1.34	7.00	5.22	14.10	4.75	630	155.00	NA	0	6.20	Fast Recharge
	MW-83A	12/13/94	1.50	2.03	13.00	6.40	11.50	6.85	380	7.60	0.00	131	3.20	Fast Recharge
	MW-84A	12/12/94	1.00	2.83	8.50	3.00	17.40	6.50	524	42.00	NA	NA	2.50	Fast Recharge
	MW-85A	12/12/94	0.80	2.94	15.00	5.10	17.20	4.50	2	6.00	0.00	-80	2.00	Fast Recharge
	MW-86A	12/13/94	0.80	1.82	10.00	5.49	14.50	5.16	6	13.00	0.00	151	5.20	Fast Recharge
	MW-86C	12/13/94	5.20	57.16	190.00	3.32	13.00	7.20	2	9.00	0.00	-55	5.00	Fast Recharge
	MW-87A	12/12/94	0.50	1.52	12.00	7.89	15.00	5.35	1	20.00	0.00	260	3.80	Fast Recharge
	MW-87C	12/12/94	2.50	36.90	111.00	3.01	13.90	7.00	2	4.00	0.00	-80	2.00	Fast Recharge
	MW-88A	12/12/94	2.00	1.50	40.00	26.67	12.00	4.40	139	31.00	0.00	-51	3.10	Fast Recharge
	MW-88C (2)	12/12/94	2.00	55.28	80.00	1.45	14.50	5.00	320	31.00	0.00	13	5.00	Very Slow Recharge
	MW-89A (2)	12/15/94	0.20	0.88	2.50	2.84	12.10	6.14	78	199.00	0.00	62	2.50	Very Slow Recharge
	MW-89C	12/15/94	2.50	40.70	125.00	3.07	12.70	7.16	6	2.80	0.00	12	1.40	Slow Recharge

Notes: See Page 5 of 5.

TABLE 3-5
SUMMARY OF MONITORING WELL PURGING
ROUND 1 AND 2 GROUNDWATER SAMPLING EVENTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLING EVENT	MONITORING WELL ID	DATE PURGED	AVERAGE PURGE RATE (GPM)	ONE WELL VOLUME [Gallons]	TOTAL PURGE VOLUME [Gallons]	NUMBER OF WELL VOLUMES PURGED	FINAL TEMP [Celcius]	FINAL PH [S.U.]	FINAL SPECIFIC CONDUCTIVITY [US/CM]	FINAL TURBIDITY [NTU]	FINAL SALINITY [ppt]	FINAL eH [mV]	FINAL DISSOLVED OXYGEN [mg/l]	COMMENTS
ROUND 2 (CON'T)	MW-90A	12/15/94	1.00	2.23	16.00	7.17	13.20	6.93	2950	28.00	6.00	-104	1.40	Fast Recharge
	MW-90B	12/15/94	0.80	3.88	15.00	3.87	12.70	6.73	462	3.80	14.00	-93	1.20	Fast Recharge
	MW-90C (2) (3)	12/15/94	2.20	55.67	55.00	0.99	11.00	7.50	320	40.00	14.00	-151	1.60	Very Slow Recharge
	MW-91A	12/15/94	1.00	3.40	20.00	5.88	12.10	6.68	165	8.70	7.50	-52	2.00	Fast Recharge
	MW-91B	12/15/94	1.00	6.64	35.00	5.27	11.90	6.35	212	6.50	8.00	6	1.80	Fast Recharge
	MW-92B	12/15/94	1.20	3.77	20.00	5.31	12.30	6.99	540	19.00	3.50	-70	1.50	Fast Recharge
	MW-93A	12/15/94	0.50	3.50	12.50	3.57	13.60	6.31	6820	65.00	12.70	NA	0.00	Fast Recharge
	MW-93B	12/15/94	1.90	5.80	24.00	4.14	12.00	5.96	9490	150.00	20.70	NA	1.30	Fast Recharge
	MW-94A	12/16/94	1.00	2.10	17.00	8.10	10.00	6.00	1500	40.00	12.00	NA	2.20	Fast Recharge
	MW-95A	12/16/94	0.20	2.33	11.50	4.94	9.00	NA	7500	>200	7.10	NA	3.80	Slow Recharge, H2S Odor
	MW-96A	12/14/94	4.00	7.68	40.00	5.21	11.70	7.05	71	8.30	NA	50	2.20	Fast Recharge
	MW-96C (2)	12/14/94	0.90	49.57	75.00	1.51	11.20	5.93	159	4.80	8.00	110	2.10	Very Slow Recharge
	MW-97A	12/16/94	2.00	4.65	60.00	12.90	11.00	7.17	11100	23.18	8.80	-132	1.10	Fast Recharge
	MW-97B	12/16/94	2.00	8.10	40.00	4.94	11.00	6.50	12000	11.10	9.70	-47	1.10	Fast Recharge
	MW-98A	12/13/94	1.00	4.69	18.40	3.92	12.40	5.97	1390	40.00	3.50	NA	0.71	Fast Recharge
	MW-98B	12/13/94	1.00	7.00	21.00	3.00	11.60	5.71	1190	42.00	NA	23	1.37	Fast Recharge
	MW-99A	12/14/94	2.00	3.65	20.00	5.48	12.50	6.87	5550	2.61	4.10	-102	0.50	Fast Recharge
	MW-99B	12/14/94	2.00	5.53	40.00	7.23	11.00	6.55	4010	6.61	9.50	-32	0.37	Fast Recharge
	MW-100A	12/14/94	2.00	1.08	17.00	15.74	11.50	6.85	1800	17.64	2.30	-89	1.30	Fast Recharge
	MW-101A	12/14/94	0.90	4.78	25.00	5.23	10.00	7.04	300	7.60	8.00	-114	3.30	Fast Recharge
	MW-103A	12/12/94	2.00	1.57	50.00	31.85	13.50	5.91	180	10.71	0.00	140	2.20	Fast Recharge
	MW-103C (2) (3)	12/12/94	2.00	42.88	90.00	2.10	13.00	7.91	271	0.31	0.00	46	1.90	Very Slow Recharge
	MW-104A	12/12/94	2.00	1.59	30.00	18.87	14.60	1.91	2	36.30	0.00	40	7.80	Fast Recharge
	MW-104C (2)	12/12/94	0.50	39.00	46.00	1.18	10.70	2.96	230	124.10	0.00	-124	5.60	Slow, Turbid, Light Brown Color
	MW-105A	12/12/94	1.00	1.85	7.30	3.95	13.40	8.34	118	180.00	0.00	NA	3.40	Fast Recharge, Turbid
	MW-105C	12/12/94	4.00	60.06	180.00	3.00	12.60	7.56	236	47.00	0.00	NA	1.50	Fast Recharge, Turbid, Tan

Notes:

mV - millivolts
NA - Not analyzed
S.U. - Standard Units
GPM - Gallons per minute
[ppt] - Parts per thousand
PHC - Petroleum hydrocarbon

[NTU] - Nephelometric tubidity units
[us/cm] - Microsiemens per centimeter
mg/l - Milligram per liter or parts per milion
(1) - Well sampled twice (see Tables 3-6 and 3-7)
(2) - Identified as Low Yield Well (See text Section 3.3.3.3)
(3) - Well was purged dry. Due to very slow recovery well was sampled the following day (within 24 hours of purging).

TABLE 3-6
SUMMARY OF ROUND 1 GROUNDWATER SAMPLING PROGRAM
8 THROUGH 18 NOVEMBER 1994
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

AREA	MONITORING WELL ID	DATE SAMPLE COLLECTED	ANALYTICAL PARAMETERS												
			TCL VOC	TCL SVOC	P/PCB	CYANIDE	PPM+Ba	TAL METALS	EXP (8330)	NG & PETN	THIO-DIGLYCOL	DIOXIN/ FURAN	OIL/ GREASE	TDS	HARDNESS
19 [9]	MW-6	11/11/94	X	X	X		X		X				X	X	X
19 [9]	MW-6C	11/11/94	X	X	X		X		X						
1	MW-7	11/11/94	X	X	X		X		X						
1	MW-8	11/11/94	X	X	X		X		X						
1	MW-9	11/11/94	X	X	X	X		X	X						
20 [7]	MW-10	11/10/94	X	X	X		X		X		X				
[7]	MW-11	11/08/94	X	X	X		X		X		X		X	X	X
7	MW-12	11/10/94	X	X	X	X		X	X		X				
[2]	MW-13	11/9/94	X	X	X		X		X				X		
[2/3/7]	MW-14	11/11/94	X	X	X	X		X	X				X	X	X
3 [2]	MW-15	11/10/94	X	X	X	X		X	X			X			
6A [6B]	MW-16	11/16/94	X	X	X		X		X		X				
4	MW-17	11/15/94	X	X	X		X		X		X				
[4/3]	MW-18	11/10/94	X	X	X		X		X		X				
[4/5]	MW-19	11/11/94	X	X	X	X		X	X		X				
5	MW-20	11/16/94	X	X	X	X	X		X		X				
5	MW-21	11/17/94	X	X	X	X		X	X		X				
5	MW-22	11/16/94	X	X	X	X		X	X		X				
6A	MW-25	11/15/94	X	X	X		X		X			X			
6A	MW-26	11/16/94	X	X	X		X		X				X	X	X
6A	MW-27	11/16/94	X	X	X	X		X	X						
11	MW-28	11/15/94	X	X	X		X		X	X					
11	MW-28B	11/15/94	X	X	X		X		X	X			X	X	X
11	MW-29	11/15/94	X	X	X		X		X	X					
11	MW-30	11/15/94	X	X	X		X		X	X					
1	MW-31	11/11/94	X	X	X		X		X				X	X	X
[5/6/6A/6B]	MW-34	11/16/94	X	X	X	X		X	X		X				
4	MW-42A	11/14/94	X	X	X		X		X		X		X	X	X
[2/3/4]	MW-43	11/11/94	X	X	X		X		X		X				
6A [6]	MW-44	11/15/94	X	X	X		X		X			X			
14 [6/6B]	MW-45	11/16/94	X	X	X		X		X		X				

Notes: See Page 4 of 4.

TABLE 3-6
SUMMARY OF ROUND 1 GROUNDWATER SAMPLING PROGRAM
8 THROUGH 18 NOVEMBER 1994
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

AREA	MONITORING WELL ID	DATE SAMPLE COLLECTED	ANALYTICAL PARAMETERS												
			TCL VOC	TCL SVOC	P/PCB	CYANIDE	PPM+Ba	TAL METALS	EXP (8330)	NG & PETN	THIO-DIGLYCOL	DIOXIN/ FURAN	OIL/ GREASE	TDS	HARDNESS
10	MW-46A	11/9/94	X	X	X	X		X	X						
19 [9]	MW-47A	11/9/94	X	X	X		X		X						
19 [9]	*MW-47C**	11/10/94	X	X	X	X		X	X						
9	MW-48A	11/11/94	X	X	X		X		X						
9	MW-48B	11/11/94	X	X	X	X		X	X						
19 [10]	MW-49	11/9/94	X	X	X	X		X	X						
19	MW-49C	11/9/94	X	X	X		X		X				X	X	X
14	MW-50	11/15/94	X	X	X	X		X	X						
14	MW-50B	11/15/94	X	X	X		X		X						
14	MW-50C	11/15/94	X	X	X		X		X				X	X	X
16	MW-51	11/14/94	X	X	X		X		X						
16	MW-52A	11/15/94	X	X	X		X		X						
16	MW-52B	11/15/94	X	X	X	X		X	X						
16	*MW-53***	11/14/94	X	X	X		X		X						
[16/19]	MW-54	11/14/94	X	X	X		X		X						
10	MW-56	11/9/94	X	X	X	X		X	X				X	X	X
10	MW-57	11/9/94	X	X	X	X		X	X						
3 [2]	MW-58	11/8/94	X	X	X	X		X	X						
7	MW-59	11/10/94	X	X	X		X		X		X				
7	MW-59C	11/10/94	X	X	X	X		X	X		X				
12	MW-60	11/14/94	X	X	X		X		X	X			X	X	X
12	MW-60B	11/14/94	X	X	X		X		X	X			X	X	X
12	MW-60C	11/18/94	X	X	X	X		X	X	X					
[4/6/7]	MW-61	11/17/94	X	X	X		X		X		X		X	X	X
6	MW-62	11/11/94	X	X	X	X		X	X		X				
[12]	MW-63	11/15/94	X	X	X	X		X	X	X					
[12]	MW-63A	11/15/94	X	X	X		X		X	X					
5	MW-65	11/16/94	X	X	X		X		X		X				
5	MW-66	11/16/94	X	X	X	X		X	X		X		X	X	X
5	MW-67	11/16/94	X	X	X	X	X		X		X				
Bldg. 118	MW-68A	11/9/94					X		X						
10	MW-69A	11/9/94	X	X	X		X		X						
10	MW-70A	11/9/94	X	X	X		X		X						
18A	MW-71C	11/10/94	X	X	X	X		X	X						
[4]	MW-75A	11/11/94	X	X	X		X		X		X				

Notes: See Page 4 of 4.

TABLE 3-6
SUMMARY OF ROUND 1 GROUNDWATER SAMPLING PROGRAM
8 THROUGH 18 NOVEMBER 1994
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

AREA	MONITORING WELL ID	DATE SAMPLE COLLECTED	ANALYTICAL PARAMETERS												
			TCL VOC	TCL SVOC	P/PCB	CYANIDE	PPM+Ba	TAL METALS	EXP (8330)	NG & PETN	THIO-DIGLYCOL	DIOXIN/FURAN	OIL/GREASE	TDS	HARDNESS
[4]	MW-75C	11/11/94	X	X	X		X		X		X				
4	MW-76A	11/10/94	X	X	X	X		X	X		X				
4	MW-76B	11/11/94	X	X	X		X		X		X				
4	MW-76C	11/10/94	X	X	X		X		X		X				
14	MW-77A	11/8/94	X	X	X	X		X	X						
14	MW-77B	11/8/94	X	X	X		X		X						
14	MW-78A	11/8/94	X	X	X		X		X						
8	MW-79B	11/14/94	X	X	X		X		X		X		X	X	X
8	MW-79C	11/14/94	X	X	X	X		X	X		X				
19	MW-80A	11/14/94	X	X	X		X		X						
151	MW-81A	11/8/94	X	X	X		X		X			X			
OWENS	MW-82A	11/8/94	X	X	X	X		X	X				X	X	X
15	MW-83A	11/8/94	X	X	X		X		X						
[15]	MW-84A	11/8/94	X	X	X		X		X						
[15]	MW-85A	11/8/94	X	X	X		X		X						
[15]	MW-86A	11/8/94	X	X	X		X		X						
[15]	MW-86C	11/8/94	X	X	X	X		X	X				X	X	X
18D	MW-87A	11/9/94	X	X	X		X		X				X	X	X
18D	MW-87C	11/9/94	X	X	X		X		X						
18C	MW-88A	11/10/94	X	X	X		X		X						
18C	MW-88C	11/10/94	X	X	X	X		X	X						
10	MW-89A	11/18/94	X	X	X		X		X						
10	MW-89C	11/17/94	X	X	X		X		X						
16	MW-90A	11/14/94	X	X	X	X		X	X				X	X	X
16	MW-90B	11/14/94	X	X	X		X		X						
16	MW-90C	11/18/94	X	X	X	X		X	X				X	X	X
16	MW-91A	11/15/94	X	X	X		X		X						
16	MW-91B	11/15/94	X	X	X		X		X						
16	MW-92B	11/14/94	X	X	X		X		X						
16	MW-93A	11/15/94	X	X	X		X		X						
16	MW-93B	11/15/94	X	X	X		X		X						
6	MW-94A	11/17/94	X	X	X		X		X		X				
6	MW-95A	11/17/94	X	X	X		X		X		X				
6	MW-96A	11/17/94	X	X	X	X		X	X		X				

Notes: See Page 4 of 4.

TABLE 3-6
SUMMARY OF ROUND 1 GROUNDWATER SAMPLING PROGRAM
8 THROUGH 18 NOVEMBER 1994
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

AREA	MONITORING WELL ID	DATE SAMPLE COLLECTED	ANALYTICAL PARAMETERS													
			TCL VOC	TCL SVOC	P/PCB	CYANIDE	PPM+Ba	TAL METALS	EXP (8330)	NG & PETN	THIO-DIGLYCOL	DIOXIN/ FURAN	OIL/ GREASE	TDS	HARDNESS
6	MW-96C	11/17/94	X	X	X		X		X		X		X	X	X
6	MW-97A	11/16/94	X	X	X	X		X	X				X	X	X
6	MW-97B	11/17/94	X	X	X	X		X	X						
14	MW-98A	11/16/94	X	X	X		X		X		X	X			
14	MW-98B	11/16/94	X	X	X		X		X		X		X	X	X
[6B]	MW-99A	11/16/94	X	X	X	X		X	X		X	X			
[6B]	MW-99B	11/16/94	X	X	X		X		X		X				
11	MW-100A	11/14/94	X	X	X	X		X	X	X					
[11/16]	MW-101A	11/14/94	X	X	X		X		X	X					
BKG	MW-103A	11/17/94	X	X	X		X		X						
BKG	MW-103C	11/18/94	X	X	X	X		X	X		X		X	X	X
BKG	MW-104A	11/17/94	X	X	X		X		X		X		X	X	X
BKG	MW-104C	11/17/94	X	X	X		X		X						
BKG	MW-105A	11/9/94	X	X	X		X		X						
BKG	MW-105C	11/9/94	X	X	X		X		X						
18A	MW-EPA-2A	11/10/94	X	X	X		X		X				X	X	X
Bldg. 151	MW-SA4	11/8/94	X	X	X		X		X						
Bldg. 151	MW-SA5	11/10/94	X	X	X	X		X	X						
Bldg. 151	MW-SPCl4	11/8/94	X	X	X		X		X						

Notes:
TDS - Total dissolved solids
EXP - Full Method 8330 explosives analysis
TAL Metals - USEPA Target Analyte List Metals
PPM+Ba - Priority Pollutant Metals plus Barium
* - MW-47C was resampled 11/17/94 for TAL Metals
** - MW-53 was resampled 11/18/94 for SVOC, P/PCB, and PPM+Ba
P/PCB - Analysis for both TCL Pesticides and Polychlorinated Biphenyls
TCL VOC - USEPA Target Compound List (TCL) Volatile Organic Compounds
TCL SVOC - USEPA Target Compound List (TCL) Semivolatile Organic Compounds
NG & PETN - Nitroglycerin and Pentaerythritol Tetranitrate added to Method 8330 Explosives
[ ] - indicates the area(s) the wells are adjacent to or associated with, since they are not within area boundaries. The well could be located upgradient, downgradient or sidegradient to the area indicated. For the position of the monitoring well in relation to the area see Figure 1-2. These wells were assigned to area by Dames & Moore or Roy F. Weston.

TABLE 3-7
SUMMARY OF ROUND 2 GROUNDWATER SAMPLING PROGRAM
12 THROUGH 16 DECEMBER 1994
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

AREA	MONITORING WELL ID	DATE SAMPLE COLLECTED	ANALYTICAL PARAMETERS									
			TCL VOC	TCL SVOC	P/PCB	CYANIDE	PPM+Ba	TAL METALS	EXP (8330)	NG & PETN	THIO-DIGLYCOL	DIOXIN/ FURAN
19 [9]	MW-6C	12/15/94	X	X	X		X		X			
11	MW-28B	12/14/94	X	X	X		X		X	X		
BKG [2]	MW-40	12/12/94	X	X	X	X		X	X			
19 [9]	MW-47C	12/13/94	X	X	X	X		X	X			
19	MW-49C	12/14/94	X	X	X		X		X			
14	MW-50B	12/13/94	X	X	X		X		X			
14	MW-50C	12/13/94	X	X	X		X		X			
7	MW-59C	12/13/94	X	X	X	X		X	X		X	
12	MW-60B	12/15/94	X	X	X		X		X	X		
12	MW-60C	12/15/94	X	X	X	X		X	X	X		
[12]	MW-63A	12/14/94	X	X	X		X		X	X		
5	MW-65	12/15/94	X	X	X		X		X		X	
5	MW-66	12/15/94	X	X	X	X		X	X		X	
5	MW-67	12/15/94	X	X	X		X		X		X	
Bldg. 118	MW-68A	12/14/94					X		X			
10	MW-69A	12/15/94	X	X	X		X		X			
10	MW-70A	12/14/94	X	X	X		X		X			
18A	MW-71C	12/12/94	X	X	X	X		X	X			
[4]	MW-75A	12/13/94	X	X	X		X		X		X	
[4]	MW-75C	12/13/94	X	X	X		X		X		X	
4	MW-76A	12/13/94	X	X	X	X		X	X		X	
4	MW-76B	12/13/94	X	X	X		X		X		X	
4	MW-76C	12/13/94	X	X	X		X		X		X	
14	MW-77A	12/13/94	X	X	X	X		X	X			
14	MW-77B	12/13/94	X	X	X		X		X			
14	MW-78A	12/13/94	X	X	X		X		X			
8	MW-79B	12/14/94	X	X	X		X		X		X	
8	MW-79C	12/14/94	X	X	X	X		X	X		X	
19	MW-80A	12/14/94	X	X	X		X		X			
OWENS	MW-82A	12/12/94	X	X	X	X		X	X			
15	MW-83A	12/13/94	X	X	X		X		X			
[15]	MW-84A	12/12/94	X	X	X		X		X			
[15]	MW-85A	12/12/94	X	X	X		X		X			
[15]	MW-86A	12/13/94	X	X	X		X		X			
[15]	MW-86C	12/13/94	X	X	X	X		X	X			
18D	MW-87A	12/12/94	X	X	X		X		X			

Notes: See Page 2 of 2.

TABLE 3-7
SUMMARY OF ROUND 2 GROUNDWATER SAMPLING PROGRAM
12 THROUGH 16 DECEMBER 1994
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

AREA	MONITORING WELL ID	DATE SAMPLE COLLECTED	ANALYTICAL PARAMETERS									
			TCL VOC	TCL SVOC	P/PCB	CYANIDE	PPM+Ba	TAL METALS	EXP (8330)	NG & PETN	THIO-DIGLYCOL	DIOXIN/ FURAN
18D	MW-87C	12/12/94	X	X	X		X		X			
18C	MW-88A	12/12/94	X	X	X		X		X			
18C	MW-88C	12/12/94	X	X	X	X		X	X			
10	MW-89A	12/15/94	X	X	X		X		X			
10	MW-89C	12/15/94	X	X	X		X		X			
16	MW-90A	12/15/94	X	X	X	X		X	X			
16	MW-90B	12/15/94	X	X	X		X		X			
16	MW-90C	12/16/94	X	X	X	X		X	X			
16	MW-91A	12/15/94	X	X	X		X		X			
16	MW-91B	12/15/94	X	X	X		X		X			
16	MW-92B	12/15/94	X	X	X		X		X			
16	MW-93A	12/15/94	X	X	X		X		X			
16	MW-93B	12/15/94	X	X	X		X		X			
6	MW-94A	12/16/94	X	X	X		X		X		X	
6	MW-95A	12/16/94	X	X	X		X		X		X	
6	MW-96A	12/14/94	X	X	X	X		X	X		X	
6	MW-96C	12/14/94	X	X	X		X		X		X	
6	MW-97A	12/16/94	X	X	X	X		X	X			
6	MW-97B	12/16/94	X	X	X	X		X	X			
14	MW-98A	12/13/94	X	X	X		X		X		X	X
14	MW-98B	12/13/94	X	X	X		X		X		X	
[6B]	MW-99A	12/14/94	X	X	X	X		X	X		X	X
[6B]	MW-99B	12/14/94	X	X	X		X		X		X	
11	MW-100A	12/14/94	X	X	X	X		X	X	X		
[11/16]	MW-101A	12/14/94	X	X	X		X		X	X		
BKG	MW-103A	12/12/94	X	X	X		X		X			
BKG	MW-103C	12/13/94	X	X	X	X		X	X		X	
BKG	MW-104A	12/12/94	X	X	X		X		X		X	
BKG	MW-104C	12/12/94	X	X	X		X		X			
BKG	MW-105A	12/12/94	X	X	X		X		X			
BKG	MW-105C	12/12/94	X	X	X		X		X			

Notes:

EXP - Full Method 8330 explosives analysis
TAL Metals - USEPA Target Analyte List Metals
PPM+Ba - Priority Pollutant Metals plus Barium
P/PCB - Analysis for both TCL Pesticides and Polychlorinated Biphenyls
TCL VOC - USEPA Target Compound List (TCL) Volatile Organic Compounds
TCL SVOC - USEPA Target Compound List (TCL) Semivolatile Organic Compounds
NG & PETN - Nitroglycerin and Pentaerythritol Tetranitrate added to Method 8330 Explosives
[ ] - indicates the area(s) the wells are adjacent to or associated with, since they are not within area boundaries. The well could be located upgradient, downgradient or sidegradient to the area indicated. For the position of the monitoring well in relation to the area see Figure 1-2. These wells were assigned to area by Dames & Moore or Roy F. Weston.

TABLE 3-8
SUMMARY OF ROUND 1 GROUNDWATER SAMPLING QUALITY ASSURANCE/QUALITY CONTROL PROGRAM
8 THROUGH 18 NOVEMBER 1994
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	DATE SAMPLE COLLECTED	QA/QC SAMPLE TYPE	ANALYTICAL PARAMETERS
FB1-MW-11	8-Nov-94	Field Blank	Thiodiglycol
FB1-MW-77A	8-Nov-94	Field Blank	VOC, SVOC, Pest/PCB, TAL Metals + CN, Exp (8330)
2742-GW1-MW-85A	8-Nov-94	QA Duplicate of GW1-MW-85A	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330)
GW1-MW-200A	8-Nov-94	QC Duplicate of GW1-MW-85A	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330)
FB1-MW-81A	8-Nov-94	Field Blank	Dioxin/Furan
GW1-TBLK1	8-Nov-94	Trip Blank	VOC
FB1-MW-77A	8-Nov-94	MS/MSD	TAL Metals (minus Cadmium, Mercury, Lead, Thallium)
GW1-MW-82A	8-Nov-94	MS/MSD	Mercury
GW1-MW-84A	8-Nov-94	MS/MSD	Mercury
GW1-MW-86C	8-Nov-94	MS/MSD	Cyanide, Cadmium, Lead, Thallium
2742-GW1-MW-49C	9-Nov-94	QA Duplicate of GW1-MW-49C	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330)
GW1-MW-201C	9-Nov-94	QC Duplicate of GW1-MW-49C	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330)
FB1-MW-13	9-Nov-94	Field Blank	VOC, SVOC, Pest/PCB, TAL Metals + CN, Exp (8330)
GW1-MW56	9-Nov-94	MS/MSD	TAL Metals (minus Mercury)
GW1-MW-57	9-Nov-94	MS/MSD	Mercury
GW1-MW-105C	9-Nov-94	MS/MSD	Mercury
TB-9NOV94	9-Nov-94	Trip Blank	VOC
FB1-MW-76A	10-Nov-94	Field Blank	VOC, SVOC, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330)
TB-10NOV94	10-Nov-94	Trip Blank	VOC
2742-GW1-MW-59C	10-Nov-94	QA Duplicate of GW1-MW-59C	VOC, SVOC, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330)
GW1-MW-202	10-Nov-94	QC Duplicate of GW1-MW-59C	VOC, SVOC, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330)
FB1-MW-15	10-Nov-94	Field Blank	Dioxin/Furan

Notes:

CN - Cyanide
Pest - Pesticides
PCBs - Polychlorinated biphenyls
Exp (8330) - Full Method 8330 explosives
QA/QC - Quality Control/Quality Assurance
TAL Metals - USEPA Target Analyte List Metals
MS/MSD - Matrix Spike/Matrix Spike Duplicate
PPM+Ba - USEPA Priority Pollutant Metals plus barium
SVOC - USEPA TCL Semivolatile Organic Compounds
NG & PETN - Nitroglycerin and Pentaerythritol Tetranitrate
VOC - USEPA Target Compound List (TCL) Volatile Organic Compounds

1. QC duplicates were sent to a WESTON Laboratory.
2. QA duplicates were sent to the USACE Missouri River Division (MRD) Laboratory.

TABLE 3-8
SUMMARY OF ROUND 1 GROUNDWATER SAMPLING QUALITY ASSURANCE/QUALITY CONTROL PROGRAM
8 THROUGH 18 NOVEMBER 1994
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	DATE SAMPLE COLLECTED	QA/QC SAMPLE TYPE	ANALYTICAL PARAMETERS
GW1-MW-15	10-Nov-94	MS/MSD	VOC, SVOC, Dioxin/Furan, Pest/PCB, TAL Metals+CN, Exp (8330)
GW1-MW-18	10-Nov-94	MS/MSD	Mercury
TB-11NOV94	11-Nov-94	Trip Blank	VOC
FB1-MW-62	11-Nov-94	Field Blank	VOC, SVOC, Dioxin/Furan, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330)
GW1-MW-43	11-Nov-94	MS/MSD	VOC, SVOC, Pest/PCB, PPM+Ba, Thiodiglycol, Exp (8330)
GW1-MW-62	11-Nov-94	MS/MSD	TAL Metals (minus Cadmium, Mercury, Lead, Selenium, Thallium)
FB1-MW-62	11-Nov-94	MS/MSD	Mercury
TB-14NOV94	14-Nov-94	Trip Blank	VOC
FB1-MW-90A	14-Nov-94	Field Blank	VOC, SVOC, Dioxin/Furan, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330), NG+PETN
2742-GW1-MW-80A	14-Nov-94	QA Duplicate of GW1-MW-80A	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330)
GW1-MW-203A	14-Nov-94	QC Duplicate of GW1-MW-80A	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330)
2742-GW1-MW-60	14-Nov-94	QA Duplicate of GW1-MW-60	Exp (8330), NG+PETN
GW1-MW-204	14-Nov-94	QC Duplicate of GW1-MW-60	Exp (8330), NG+PETN
GW1-MW-54	14-Nov-94	MS/MSD	Mercury
GW1-MW-79C	14-Nov-94	MS/MSD	Cyanide
GW1-MW-90A	14-Nov-94	MS/MSD	TAL Metals (minus Mercury)
FB1-MW-90A	14-Nov-94	MS/MSD	Mercury
TB-15NOV94	15-Nov-94	Trip Blank	VOC
FB1-MW-28B	15-Nov-94	Field Blank	VOC, SVOC, Dioxin/Furan, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330), NG+PETN
2742-GW1-MW-93B	15-Nov-94	QA Duplicate of GW1-MW-93B	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330)
GW1-MW-205B	15-Nov-94	QC Duplicate of GW1-MW-93B	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330)
GW1-MW-28B	15-Nov-94	MS/MSD	VOC, SVOC, Pest/PCB, PPM+Ba, TDS, Hardness, O&G, Exp (8330), NG+PETN

Notes:

CN - Cyanide
Pest - Pesticides
PCBs - Polychlorinated biphenyls
Exp (8330) - Full Method 8330 explosives
QA/QC - Quality Control/Quality Assurance
TAL Metals - USEPA Target Analyte List Metals
MS/MSD - Matrix Spike/Matrix Spike Duplicate
PPM+Ba - USEPA Priority Pollutant Metals plus barium
SVOC - USEPA TCL Semivolatile Organic Compounds
NG & PETN - Nitroglycerin and Pentaerythritol Tetranitrate
VOC - USEPA Target Compound List (TCL) Volatile Organic Compounds

1. QC duplicates were sent to a WESTON Laboratory.
2. QA duplicates were sent to the USACE Missouri River Division (MRD) Laboratory.

TABLE 3-8
SUMMARY OF ROUND 1 GROUNDWATER SAMPLING QUALITY ASSURANCE/QUALITY CONTROL PROGRAM
8 THROUGH 18 NOVEMBER 1994
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	DATE SAMPLE COLLECTED	QA/QC SAMPLE TYPE	ANALYTICAL PARAMETERS
GW1-MW-50C	15-Nov-94	MS/MSD	VOC, SVOC, Pest/PCB, PPM+Ba, TDS, Hardness, O&G, Exp (8330)
GW1-MW-52B	15-Nov-94	MS/MSD	TAL Metals (minus Arsenic, Cadmium, Lead, Selenium, Thallium)
TB-16NOV94	16-Nov-94	Trip Blank	VOC
FB1-MW-98B	16-Nov-94	Field Blank	VOC, SVOC, Dioxin/Furan, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330)
2742-GW1-MW-98A	16-Nov-94	QA Duplicate of GW1-MW-98A	Dioxin/Furan, Thiodiglycol
GW1-MW-208A	16-Nov-94	QC Duplicate of GW1-MW-98A	Dioxin/Furan, Thiodiglycol
GW1-MW-27	16-Nov-94	MS/MSD	VOC, SVOC, Pest/PCB, TAL Metals + CN, Exp (8330)
GW1-MW-65	16-Nov-94	MS/MSD	VOC, SVOC, Pest/PCB, PPM+Ba, Thiodiglycol, Exp (8330)
GW1-MW-27	16-Nov-94	MS/MSD	TAL Metals +CN
TB-17NOV94	17-Nov-94	Trip Blank	VOC
FB1-MW-103C	17-Nov-94	Field Blank	VOC, SVOC, Dioxin/Furan, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330)
2742-GW1-MW-97B	17-Nov-94	QA Duplicate of GW1-MW-97B	VOC, SVOC, Pest/PCB, TAL Metals + CN, Exp (8330)
GW1-MW-207B	17-Nov-94	QC Duplicate of GW1-MW-97B	VOC, SVOC, Pest/PCB, TAL Metals + CN, Exp (8330)
GW1-MW-47C	17-Nov-94	MS/MSD	Mercury
GW1-MW-94A	17-Nov-94	MS/MSD	Mercury
GW1-MW-97B	17-Nov-94	MS/MSD	TAL Metals (minus Mercury) + CN
FB1-MW-103A	18-Nov-94	Field Blank	VOC, SVOC, Dioxin/Furan, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330)
TB-18NOV94	18-Nov-94	Trip Blank	VOC
GW1-MW-89A	18-Nov-94	MS/MSD	Mercury
FB1-MW-103A	18-Nov-94	MS/MSD	Mercury

Notes:

CN - Cyanide
Pest - Pesticides
PCBs - Polychlorinated biphenyls
Exp (8330) - Full Method 8330 explosives
QA/QC - Quality Control/Quality Assurance
TAL Metals - USEPA Target Analyte List Metals
MS/MSD - Matrix Spike/Matrix Spike Duplicate
PPM+Ba - USEPA Priority Pollutant Metals plus barium
SVOC - USEPA TCL Semivolatile Organic Compounds
NG & PETN - Nitroglycerin and Pentaerythritol Tetranitrate
VOC - USEPA Target Compound List (TCL) Volatile Organic Compounds

1. QC duplicates were sent to a WESTON Laboratory.
2. QA duplicates were sent to the USACE Missouri River Division (MRD) Laboratory.

TABLE 3-9
SUMMARY OF ROUND 2 GROUNDWATER SAMPLING QUALITY ASSURANCE/QUALITY CONTROL PROGRAM
12 THROUGH 16 DECEMBER 1994
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	DATE SAMPLE COLLECTED	QA/QC SAMPLE TYPE	ANALYTICAL PARAMETERS
FB2-MW-103A	12-Dec-94	Field Blank	VOC, SVOC, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330)
TB-12DEC94	12-Dec-94	Trip Blank	VOC
2742-GW2-MW-105C	12-Dec-94	QA Duplicate of GW2-MW-105C	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330)
GW2-MW-210C	12-Dec-94	QC Duplicate of GW-MW-105C	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330)
GW2-MW-40A	12-Dec-94	MS/MSD	TAL Metals (w/o Mercury)
GW2-MW-88C	12-Dec-94	MS/MSD	Mercury
GW2-MW-104A	12-Dec-94	MS/MSD	Mercury
GW2-FB-MW-98A	13-Dec-94	Field Blank	VOC, SVOC, Dioxin/Furan, Pest/PCB, Thiodiglycol, Exp (8330)
GW2-FB-MW-76A	13-Dec-94	Field Blank	TAL Metals+CN
GW2-MW-47C	13-Dec-94	MS/MSD	VOC, SVOC, Pest/PCB, TAL Metals+CN, Exp (8330)
GW2-MW-98A	13-Dec-94	MS/MSD	VOC, SVOC, Dioxin/Furan, Pest/PCB, PPM+Ba, Thiodiglycol, Exp (8330)
TB-13DEC94	13-Dec-94	Trip Blank	VOC
GW2-FB-MW-99A	14-Dec-94	Field Blank	VOC, SVOC, Dioxin/Furan, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330)
TB-14DEC94	14-Dec-94	Trip Blank	VOC
2742-GW2-MW-99A	14-Dec-94	QA Duplicate of GW2-MW-99A	VOC, SVOC, Dioxin/Furan, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330)+NG & PETN
GW2-MW-208A	14-Dec-94	QC Duplicate of GW2-MW-99A	VOC, SVOC, Dioxin/Furan, Pest/PCB, TAL Metals+CN, Thiodiglycol, Exp (8330)
2742-GW2-MW-101A	14-Dec-94	QA Duplicate of GW2-MW-101A	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330), NG+PETN
GW2-MW-209A	14-Dec-94	QC Duplicate of GW2-MW-101A	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330), NG+PETN
GW2-MW-79C	14-Dec-94	MS/MSD	CN
GW2-MW-80A	14-Dec-94	MS/MSD	As, Cd, Pb, Se, Tl
GW2-MW-100A	14-Dec-94	MS/MSD	TAL Metals (w/o Mercury)
GW2-MW-208A	14-Dec-94	MS/MSD	Mercury

Notes:

CN - Cyanide
Pest - Pesticides
PCBs - Polychlorinated biphenyls
Exp (8330) - Full Method 8330 explosives
QA/QC - Quality Control/Quality Assurance
MS/MSD - Matrix Spike/Matrix Spike Duplicate
TAL Metals - USEPA Target Analyte List Metals
PPM+Ba - USEPA Priority Pollutant Metals plus barium
SVOC - USEPA TCL Semivolatile Organic Compounds
NG & PETN - Nitroglycerin and Pentaerythritol Tetranitrate
VOC - USEPA Target Compound List (TCL) Volatile Organic Compounds

1. QC duplicates were sent to a WESTON Laboratory.
2. QA duplicates were sent to the USACE Missouri River Division (MRD) Laboratory.

TABLE 3-9
SUMMARY OF ROUND 2 GROUNDWATER SAMPLING QUALITY ASSURANCE/QUALITY CONTROL PROGRAM
8 THROUGH 18 NOVEMBER 1994
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	DATE SAMPLE COLLECTED	QA/QC SAMPLE TYPE	ANALYTICAL PARAMETERS
GW2-FB-MW-90A	15-Dec-94	Field Blank	VOC, SVOC, Pest/PCB, TAL Metals+CN, Exp (8330)
GW2-FB-MW-60C	15-Dec-94	Field Blank	Exp(8330), NG+PETN
GW2-FB-MW-65	15-Dec-94	Field Blank	Thiodiglycol
GW2-MW-28B	15-Nov-94	MS/MSD	Mercury
GW2-MW-60B	15-Dec-94	MS/MSD	VOC, SVOC, Pest/PCB, PPM+Ba, Exp (8330), NG+PETN
GW2-MW-65	15-Dec-94	MS/MSD	Thiodiglycol
GW2-MW-90A	15-Dec-94	MS/MSD	TAL Metals+CN (w/o Mercury)
GW2-FB-90A	15-Dec-94	MS/MSD	Mercury
TB-15DEC94	15-Dec-94	Trip Blank	VOC
GW2-FB-MW-90C	16-Dec-94	Field Blank	VOC, SVOC, Pest/PCB, TAL Metals+CN, Exp (8330)
GW2-FB-MW-94A	16-Dec-94	Field Blank	Thiodiglycol
TB-16DEC094	16-Dec-94	Trip Blank	VOC
GW2-FB-MW90C	16-Dec-94	MS/MSD	Mercury
GW2-MW-94A	16-Dec-94	MS/MSD	Mercury

Notes:

CN - Cyanide
Pest - Pesticides
PCBs - Polychlorinated biphenyls
Exp (8330) - Full Method 8330 explosives
QA/QC - Quality Control/Quality Assurance
MS/MSD - Matrix Spike/Matrix Spike Duplicate
TAL Metals - USEPA Target Analyte List Metals
PPM+Ba - USEPA Priority Pollutant Metals plus barium
SVOC - USEPA TCL Semivolatile Organic Compounds
NG & PETN - Nitroglycerin and Pentaerythritol Tetranitrate
VOC - USEPA Target Compound List (TCL) Volatile Organic Compounds

1. QC duplicates were sent to a WESTON Laboratory.
2. QA duplicates were sent to the USACE Missouri River Division (MRD) Laboratory.

Table 3-10
Summary of Analytical Methods for Water
Former Raritan Arsenal
Edison, New Jersey

PARAMETERS	PREPARATION METHOD	ANALYSIS METHOD
TCL VOC	5030	8260
SGWS VOC (1)	5030	8010/8020
TCL SVOC/PAH	3510 or 3520	8270
TCL PESTICIDES/PCBs	3510 or 3520	8080
PP/TAL METALS - TOTAL	3005, 3010, or 3020	6010/7000 (2)
DIOXIN/FURANS	8280	8280
pH	–	9040
EXPLOSIVES (3)	–	8330
MUSTARD BREAKDOWN PRODUCT - THIODIGLYCOL	–	MRI OP (4)
TDS	–	160.1
HARDNESS	–	130.2
TOTAL CHLORINE	5050	9056
OIL AND GREASE	–	413.1
CYANIDE	–	9010

(1) GC methods proposed for SGWS for quick turnaround, low detection limit screening data only.
(2) Methods for metals are: As - 7060, Pb - 7421, Se - 7740, Tl - 7841, Hg - 7470; all others are by 6010.
(3) Explosives consist of: RDX, HMX, TNT, 24-DNT, 26-DNT, Tetryl, NB, 135-TNB, 13-DNB, 2A-4,6-DNT, 4A-2,6-DNT. (Selected samples will add PETN and nitroglycerin.)
(4) The Midwest Research Institute (MRI) Method is based on MS technique.

Reference: "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, USEPA

Laboratories:
Primary: Roy F. Weston, Inc., Analytics Laboratory - Lionville, PA
Roy F. Weston, Inc., Environmental Technology Laboratory - Lionville, PA
Midwest Research Institute-Kansas City, MO (thiodiglycol)
Backup: Roy F. Weston, Inc., University Park, IL
Roy F. Weston, Inc., Stockton, CA

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TABLE 3-11
SUMMARY OF GEOTECHNICAL SAMPLING PROGRAM
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Sample ID	Sample Depth (FT. BGS)	Date Sample Collected	Sampling Device	Sample Collected From	GEOTECHNICAL TESTING PARAMETERS				
					Particle Size	Atterberg Limits	Specific Gravity	Moisture Content	Triaxial Permeability
SS-1713A	0.0-2.0	10/15/93	Insert*	US	X	X	X	X	X
SS-1713C	4.0-6.0	10/16/93	Insert*	US	X	X	X	X	X
SS-0326A	0.0-2.0	7/18/94	Insert	US	X	X	X	X	X
SS-0334B	10.0-12.0	7/20/94	Insert	US	X	X	X	X	X
SS-0405A	0.0-2.0	4/25/94	Insert	US	X	X	X	X	X
SS-0405B	2.0-4.0	4/25/94	Insert	US	X	X	X	X	X
SS-0611A	0.0-2.0	9/1/94	Insert	US	X	X	X	X	X
SS-0613B	0.0-2.0	9/2/94	Insert	US	X	X	X	X	X
SS-06A01A	0.0-2.0	7/29/94	Insert	US	X	X	X	X	X
SS-06A08A	0.0-2.0	7/29/94	Insert	US	X	X	X	X	X
SS-0703B	3.0-5.0	7/25/94	Insert	US	X	X	X	X	X
SS-0705A	1.0-3.0	7/25/94	Insert	US	X	X	X	X	X
SS-0801B	5.0-7.0	7/26/94	Insert	US	X	X	X	X	X
SS-0802A	2.0-4.0	7/26/94	Insert	US	X	X	X	X	X
SS-0901A	1.0-3.0	7/26/94	Insert	US	X	X	X	X	X
SS-0902B	4.0-6.0	7/27/94	Insert	US	X	X	X	X	X
SS-1001A	0.0-2.0	4/22/94	Insert	US	X	X	X	X	X
SS-1001B	4.0-5.0	4/22/94	Insert	US	X	X	X	X	X
SS-1002A	0.0-2.0	4/22/94	Insert	US	X	X	X	X	X
SS-1101A	0.0-2.0	10/5/94	Insert	US	X	X	X	X	X
SS-1106A	0.0-2.0	10/6/94	Insert	US	X	X	X	X	X
SS-11807A	4.0-6.0	4/15/94	Insert	US	X	X	X	X	X
SS-11809A	4.0-6.0	4/18/94	Insert	US	X	X	X	X	X
SS-1410A	2.0-4.0	7/12/94	Insert	US	X	X	X	X	X
SS-16138A	0.0-2.0	8/24/94	Insert	US	X	X	X	X	X
SS-1636A	4.0-6.0	8/11/94	Insert	US	X	X	X	X	X
SS-1688A	2.0-4.0	8/18/94	Insert	US	X	X	X	X	X
SS-1696A	2.0-4.0	8/18/94	Insert	US	X	X	X	X	X
SS-18A03A	0.0-2.0	4/14/94	Insert	US	X	X	X	X	X
SS-18A11A	0.0-2.0	5/4/94	Insert	US	X	X	X	X	X
SS-18A11B	2.0-4.0	5/4/94	Insert	US	X	X	X	X	X
SS-18A13A	0.0-2.0	5/5/94	Insert	US	X	X	X	X	X
SS-18A21A	0.0-2.0	5/5/94	Insert	US	X	X	X	X	X
SS-18A22A	0.0-2.0	5/5/94	Insert	US	X	X	X	X	X
SS-18A22B	4.0-6.0	5/5/94	Insert	US	X	X	X	X	X
SS-18A24A	0.0-2.0	5/13/94	Shelby	US	X	X	X	X	X
SS-1934A	0.0-2.0	8/2/94	Insert	US	X	X	X	X	X
SS-1934B	3.0-5.0	8/2/94	Insert	US	X	X	X	X	X

See notes on Page 3 of 3.

TABLE 3-11
SUMMARY OF GEOTECHNICAL SAMPLING PROGRAM
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Sample ID	Sample Depth (FT. BGS)	Date Sample Collected	Sampling Device	Sample Collected From	GEOTECHNICAL TESTING PARAMETERS				
					Particle Size	Atterberg Limits	Specific Gravity	Moisture Content	Triaxial Permeability
SS-1937B (1)	4.0-6.0	8/2/94	Insert	US	X		X		
SS-1949B	3.0-5.0	7/27/94	Insert	US	X	X	X	X	X
SS-1951A	0.0-2.0	7/27/94	Insert	US	X	X	X	X	X
SS-OWO3A	0.0-2.0	8/3/94	Insert	US	X	X	X	X	X
SS-W04A	2.0-4.0	4/13/94	Insert	US	X	X	X	X	X
SS-W05A	0.0-2.0	4/13/94	Insert	US	X	X	X	X	X
MW-91B	6.0-8.0	8/9/94	Shelby	MM	X	X	X	X	X
MW-96C	10.0-12.0	9/2/94	Shelby	MM	X	X	X	X	X
MW-96C	30.0-32.0	9/2/94	Shelby	MM	X	X	X	X	X
MW-98A	7.0-9.0	9/14/94	Insert	MM	X	X	X	X	X
SS-0324B	2.0-4.0	7/18/94	Insert	MM	X	X	X	X	X
SS-1410B	6.0-8.0	7/12/94	Insert	MM	X	X	X	X	X
SS-1429A	0.0-2.0	7/11/94	Insert	MM	X	X	X	X	X
SS-1429B	4.0-6.0	7/11/94	Insert	MM	X	X	X	X	X
SS-1713D	26-28	10/17/93	Insert*	LS	X	X	X	X	X
MW-76B	26.5-28.5	5/16/94	Shelby	LS	X	X	X	X	X
MW-79B	19.0-21.0	9/29/94	Insert	LS	X	X	X	X	X
SS-0201A	0.0-2.0	7/15/94	Insert	LS	X	X	X	X	X
SS-0202B	2.0-4.0	7/15/94	Insert	LS	X	X	X	X	X
SS-0203C	8.0-10.0	7/15/94	Insert	LS	X	X	X	X	X
SS-0207B	4.0-6.0	7/15/94	Insert	LS	X	X	X	X	X
SS-0211C	9.0-11.0	7/14/94	Insert	LS	X	X	X	X	X
SS-0321A	0.0-2.0	7/19/94	Insert	LS	X	X	X	X	X
SS-0327B	4.0-6.0	7/18/94	Insert	LS	X	X	X	X	X
SS-0328B	4.0-6.0	7/18/94	Insert	LS	X	X	X	X	X
SS-1002B	4.0-6.0	4/22/94	Insert	LS	X	X	X	X	X
SS-11802A	4.0-6.0	4/18/94	Insert	LS	X	X	X	X	X
SS-11807B	8.0-10.0	4/15/94	Insert	LS	X	X	X	X	X
SS-1607A	4.0-6.0	8/8/94	Insert	LS	X	X	X	X	X
SS-18A03B	8.0-10.0	4/14/94	Insert	LS	X	X	X	X	X
SS-18A03C	10.0-12.0	4/14/94	Insert	LS	X	X	X	X	X
SS-18A11C	4.0-6.0	5/4/94	Insert	LS	X	X	X	X	X
SS-18A13B	4.0-6.0	5/5/94	Insert	LS	X	X	X	X	X
SS-18A13C	8.0-10.0	5/5/94	Insert	LS	X	X	X	X	X
SS-18A21B	4.0-6.0	5/5/94	Insert	LS	X	X	X	X	X
SS-18A23B	2.0-4.0	5/5/94	Insert	LS	X	X	X	X	X
SS-OW03B	8.0-10.0	8/3/94	Insert	LS	X	X	X	X	X
SS-OW03C	14.0-16.0	8/3/94	Insert	LS	X	X	X	X	X

See notes on Page 3 of 3.

TABLE 3-11
SUMMARY OF GEOTECHNICAL SAMPLING PROGRAM
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Sample ID	Sample Depth (FT. BGS)	Date Sample Collected	Sampling Device	Sample Collected From	GEOTECHNICAL TESTING PARAMETERS				
					Particle Size	Atterberg Limits	Specific Gravity	Moisture Content	Triaxial Permeability
MW-47C	15.0-17.0	8/10/94	Shelby	WBK	X	X	X	X	X
MW-6C	18.0-20.0	9/9/95	Shelby	WBK	X	X	X	X	X
MW-86C	38.0-40.0	8/18/94	Shelby	WBK	X	X	X	X	X
MW-87C	51.0-53.0	9/20/94	Shelby	WBK	X	X	X	X	X
MW-89C	13.0-15.0	9/12/94	Shelby	WBK	X	X	X	X	X
MW-90C	29.0-31.0	08/16/94	Shelby	WBK	X	X	X	X	X
OB01-B	28.0-30.0	9/27/94	Shelby	WBK	X	X	X	X	X

NOTES:
LS - Lower Sand
US - Upper Sand
MM - Meadowmat
Shelby - Shelby Tube
Insert* - Acetate Insert
Insert - Stainless Steel Insert
WBK: Weathered Bedrock Group. Represents the Raritan Fire Clay unit and/or the Weathered Passaic unit.
(1) - Sample not analyzed for Atterberg Limits, moisture content or triaxial permeability because of insufficient sample volume recovered in sampling device.

TABLE 3-12
SUMMARY OF ROCK CORING PROGRAM
FORMER RARITAN ARSENAL
EDISON, NJ

MONITORING WELL ID	RUN NUMBER	DEPTH INTERVAL (FT. BGS)	CORE BARREL USED	COMMENTS
MW-6C*	1	37.9 - 47.8	HQ	CRI
	2	47.8 - 57.8	HQ	CRI
	3	57.8 - 67.86	NX	OHI
	4	67.6 - 72.25	NX	OHI
MW-47C	1	21.9 - 32.5	HQ	CRI
	2	32.5 - 36.5	NX	OHI
	3	36.5 - 37.1	NX	OHI
	4	37.6 - 42.4	NX	OHI
MW - 49C	1	39.20 - 48.25	NX	OHI
MW-50C	1	70.2 - 78.7	HQ	CRI
	2	78.7 - 80.2	HQ	CRI
	3	80.2 - 89	HQ	OHI
	4	89 - 99	HQ	OHI
	5	99 - 104.2	HQ	OHI
MW-59C	1	54 - 64	HQ	CRI
	2	64 - 69	HQ	OHI
	3	69 - 70.1	HQ	OHI
	4	70.1 - 75.4	HQ	OHI
	5	75.4 - 78.85	HQ	OHI
MW-60C	1	47 - 51.8	HQ	CRI
	2	51.8 - 57	HQ	CRI
	3	57 - 67	HQ	OHI
	4	67 - 72	HQ	OHI
	5	72 - 82	HQ	OHI
MW-71C	1	71 - 76	NX	CRI
	2	76 - 81	NX	CRI
	3	82.5 - 87.5	NX	OHI
	4	87.5 - 92.5	NX	OHI
	5	92.5 - 97.5	NX	OHI
	6	99.5 - 102.5	NX	OHI
	7	102.5 - 107.6	NX	OHI
MW-74C	1	85 - 91	NX	CRI
	2	91 - 95	NX	CRI
	3	95 - 105	NX	OHI
MW-75C	1	45.5 - 50.5	NX	CRI
	2	50.5 - 54.3	NX	CRI
	3	55.2 - 60	NX	OHI
	4	60 - 65	NX	OHI
MW-76C	1	36.5 - 41.5	NX	CRI
	2	41.5 - 46.5	NX	CRI
	3	46.5 - 49.6	NX	OHI
	4	49.6 - 52.8	NX	OHI
	5	52.8 - 57.1	NX	OHI
	6	57.1 - 58	NX	OHI
MW-79C	1	38.4 - 39.1	HQ	CRI
	2	39.1 - 43.0	HQ	CRI
	3	43.0 - 47.7	HQ	CRI
	4	47.7 - 58.0	HQ	OHI
	5	58.0 - 63.0	HQ	OHI
MW-86C	1	58.3 - 61.3	HQ	CRI
	2	61.3 - 68	HQ	CRI
	3	68.3 - 73.3	HQ	OHI
	4	73.3 - 78.3	HQ	OHI
	5	78.3 - 88.3	HQ	OHI
	6	88.3 - 93.3	HQ	OHI

NOTES:

OHI - Core obtained from open hole interval.
CRI - Core obtained from interval of competent rock which was subsequently cased off.
* - Monitoring well was abandoned during drilling and a new well was drilled. Core was obtained from both boreholes.

TABLE 3-12
SUMMARY OF ROCK CORING PROGRAM
FORMER RARITAN ARSENAL
EDISON, NJ

MONITORING WELL ID	RUN NUMBER	DEPTH INTERVAL (FT. BGS)	CORE BARREL USED	COMMENTS
MW - 87C	1	64 - 64.9	NX	CRI
	2	64.9 - 72	NX	CRI
	3	72 - 74	NX	CRI
	4	74 - 84	NX	OHI
MW-88C	1	78 - 88	HQ	CRI
	2	89 - 95	NX	OHI
	3	95 - 99	NX	OHI
MW-89C	1	28.5 - 37	HQ	CRI
	2	46.75 - 56	HQ	CRI
	3	59.3 - 62	NX	OHI
	4	62 - 68.1	NX	OHI
MW-90C*	1	41 - 46.5	HQ	CRI
	2	46.5 - 51	HQ	CRI
	3	53 - 62	HQ	CRI
	4	63.3 - 65.3	NX	OHI
	5	65.3 - 71.75	NX	OHI
	6	71.75 - 73.75	NX	OHI
	7	73.75 - 83.75	NX	OHI
	8	83.75 - 88	NX	OHI
MW-96C	1	62.5 - 72.5	HQ	CRI
	2	72.7 - 82.7	NX	OHI
MW-103C	1	74.08 - 84.08	HQ	CRI
	2	84 - 94	NX	OHI
MW-104C	1	57 - 67	HQ	CRI
	2	67 - 72	NX	OHI
	3	72 - 76.2	NX	OHI
	4	76.2 - 80.9	NX	OHI
	5	80.9 - 90.9	NX	OHI
MW-105C	1	95 - 100.8	HQ	CRI
	2	100.8 - 105.3	HQ	CRI
	3	105.5 - 113	NX	CRI
	4	113 - 115.5	NX	CRI
	5	115.5 - 125.5	NX	CRI

NOTES:

OHI - Core obtained from open hole interval.
CRI - Core obtained from interval of competent rock which was subsequently cased off.
* - Monitoring well was abandoned during drilling and a new well was drilled. Core was obtained from both boreholes.

TABLE 3-13
SUMMARY OF GROUNDWATER AND SURFACE WATER LEVEL MONITORING PROGRAM
ROUNDS 1, 2 AND 3
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL/STAFF GAUGE ID #	HYDROLOGIC UNIT	TOP OF INNER PVC CASING ELEVATION (FT. MSL)	WATER LEVEL MEASUREMENTS AND ELEVATIONS — ROUND 1: DEPTH TO WATER (Ft. Below TOC) 3-Nov-94	ROUND 1: WATER ELEVATION (FT. MSL) 3-Nov-94	ROUND 2: DEPTH TO WATER (Ft. Below TOC) 19-Jan-95	ROUND 2: WATER ELEVATION (FT. MSL) 19-Jan-95	ROUND 3: DEPTH TO WATER (Ft. Below TOC) 15-Mar-95	ROUND 3: WATER ELEVATION (FT. MSL) 16-Mar-95
MW-1	–	93.585	38.55	55.04	39.21	54.38	39.38	54.21
MW-6	LS	9.580	6.97	2.61	5.87	3.71	5.80	3.78
MW-6C	PAS	9.250	6.58	2.67	6.46	2.79	6.40	2.85
MW-7	LS	31.394	5.30	26.09	5.00	26.39	4.98	26.41
MW-8	LS	31.403	3.10	28.30	2.96	28.44	3.01	28.39
MW-9	LS	30.908	5.77	25.14	5.64	25.27	5.53	25.38
MW-10	US/MM/LS	17.146	7.78	9.37	7.01	10.14	6.85	10.30
MW-11	LS	14.848	9.95	4.90	9.04	5.81	8.84	6.01
MW-12	LS	15.865	8.83	7.04	8.10	7.77	8.08	7.79
MW-13	LS	30.039	10.51	19.53	9.47	20.57	8.86	21.18
MW-14	LS	24.177	13.98	10.20	14.11	10.07	14.04	10.14
MW-15	LS	16.728	9.02	7.71	8.39	8.34	8.37	8.36
MW-16	LS	12.089	11.37	0.72	9.76	2.33	10.14	1.95
MW-17	US/MM/LS	11.901	7.16	4.74	9.41	2.49	6.45	5.45
MW-18	LS	21.515	10.04	11.48	8.45	13.07	7.99	13.53
MW-19	LS	9.452	6.24	3.21	5.30	4.15	5.71	3.74
MW-20	LS	13.593	10.67	2.92	8.90	4.69	9.57	4.02
MW-21	LS	7.146	4.53	2.62	2.68	4.47	3.70	3.45
MW-22	LS	8.057	4.78	3.28	3.20	4.86	3.48	4.58
MW-25	US	8.376	4.14	4.24	3.42	4.96	3.44	4.94
MW-26	US/MM	12.787	8.52	4.27	6.84	5.95	6.81	5.98
MW-27	US/MM	9.059	4.86	4.20	4.24	4.82	4.24	4.82
MW-28	US	7.168	3.84	3.33	3.09	4.08	3.03	4.14
MW-28B	LS	6.810	8.77	-1.96	4.48	2.33	4.67	2.14
MW-29	US	7.826	4.65	3.18	4.35	3.48	4.44	3.39
MW-30	US	6.173	2.95	3.22	2.43	3.74	2.34	3.84
MW-31	LS/WBK	31.865	7.63	24.24	7.41	24.46	7.53	24.34
MW-34	LS	7.661	5.41	2.25	4.24	3.42	5.26	2.41
MW-40	LS	61.554	8.81	52.74	9.00	52.55	8.58	52.97
MW-42A	LS	13.707	6.84	6.87	6.22	7.49	8.18	5.53
MW-43	MM/LS	13.852	8.83	5.02	8.10	5.75	7.96	5.89
MW-44	LS	7.399	6.37	1.03	4.92	2.48	5.52	1.88
MW-45	US/MM/LS	11.698	8.58	3.12	6.96	4.74	7.61	4.09
MW-46A	MM/LS	31.556	2.97	28.59	2.67	28.89	2.52	29.04
MW-47A	LS	17.020	9.12	7.90	8.78	8.24	8.73	8.29
MW-47C	PAS	16.790	9.07	7.72	8.20	8.59	7.88	8.91
MW-48A	LS	9.410	6.22	3.19	5.84	3.58	5.67	3.74
MW-48B	LS	7.875	4.70	3.18	4.30	3.58	4.12	3.76
MW-49	LS	13.430	6.52	6.91	5.63	7.80	5.48	7.95
MW-49C	PAS	12.450	5.64	6.81	4.83	7.62	4.67	7.78
MW-50	US/MM	13.200	6.43	6.77	4.49	8.71	5.48	7.73
MW-50B	LS	12.490	10.73	1.76	8.70	3.79	9.10	3.39
MW-50C	PAL	12.900	10.88	2.02	10.12	2.78	10.15	2.75
MW-51	MM/LS	8.767	7.35	1.42	6.73	2.04	6.76	2.01
MW-52A	US/MM	10.282	8.61	1.67	8.16	2.12	8.02	2.26
MW-52B	LS	9.557	8.27	1.29	7.69	1.87	7.71	1.85
MW-53	US/MM	7.729	5.48	2.25	4.64	3.09	4.63	3.10
MW-54	MM/LS	6.644	5.70	0.94	5.40	1.24	5.31	1.33
MW-55A	LS	50.565	7.08	43.49	5.24	45.33	5.01	45.56
MW-55B	LS	49.475	9.39	40.09	8.85	40.63	8.61	40.87
MW-56	LS	24.631	7.13	17.50	4.84	19.79	4.95	19.68
MW-57	LS	47.128	8.30	38.83	8.16	38.97	7.80	39.33
MW-58	US/LS	26.352	8.74	17.61	7.81	18.54	6.92	19.43

See notes on Page 4 of 4.

TABLE 3-13
SUMMARY OF GROUNDWATER AND SURFACE WATER LEVEL MONITORING PROGRAM
ROUNDS 1, 2 AND 3
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL/STAFF GAUGE ID #	HYDROLOGIC UNIT	TOP OF INNER PVC CASING ELEVATION (FT. MSL)	WATER LEVEL MEASUREMENTS AND ELEVATIONS					
			ROUND 1		ROUND 2		ROUND 3	
			DEPTH TO WATER (Ft. Below TOC) 3-Nov-94	WATER ELEVATION (FT. MSL) 3-Nov-94	DEPTH TO WATER (Ft. Below TOC) 19-Jan-95	WATER ELEVATION (FT. MSL) 19-Jan-95	DEPTH TO WATER (Ft. Below TOC) 16-Mar-95	WATER ELEVATION (FT. MSL) 16-Mar-95
MW-59	LS	13.840	6.99	6.85	6.54	7.30	6.45	7.39
MW-59C	PAS	12.044	2.25	9.79	6.65	5.39	6.66	5.38
MW-60	MM	8.694	5.45	3.24	3.87	4.82	4.05	4.65
MW-60B	LS	8.860	8.60	0.26	6.34	2.52	6.59	2.27
MW-60C	PAL	8.330	7.57	0.76	6.63	1.70	6.60	1.73
MW-61	US/MM/LS	12.787	9.21	3.58	8.67	4.12	8.70	4.08
MW-62	LS	12.447	15.40	-2.95	14.66	-2.21	14.64	-2.19
MW-63	LS	9.252	10.10	-0.85	7.35	1.90	7.45	1.80
MW-63A	US	9.150	5.83	3.32	4.64	4.51	4.51	4.64
MW-64	LS	66.170	15.80	50.37	15.86	50.31	15.71	50.46
MW-65	US/MM/LS	10.271	NM	NM	6.08	4.19	8.26	2.01
MW-66	LS	10.161	8.47	1.69	5.97	4.19	8.20	1.96
MW-67	US/MM/LS	10.304	8.14	2.16	5.16	5.14	5.30	5.01
MW-68A	LS	82.230	27.06	55.17	28.00	54.23	27.89	54.34
MW-69A	LS	44.210	6.69	37.52	6.22	37.99	6.25	37.96
MW-70A	LS	22.140	11.33	10.81	10.00	12.14	9.70	12.44
MW-71C	PAS	53.520	19.39	34.13	19.12	34.40	19.05	34.47
MW-72A	LS	58.860	14.06	44.80	14.23	44.63	14.08	44.78
MW-73A	LS	76.450	29.51	46.94	30.18	46.27	30.32	46.13
MW-74B	LS	100.740	53.50	47.24	53.82	46.92	51.68	49.06
MW-74C	PAS	100.520	50.51	50.01	51.41	49.11	52.55	47.97
MW-75A	US/LS	11.350	6.86	4.49	9.12	2.23	6.10	5.25
MW-75C	PAS	11.260	8.17	3.09	8.51	2.75	6.10	5.16
MW-76A	US	13.840	9.28	4.56	7.72	6.12	7.49	6.35
MW-76B	LS	14.240	9.62	4.62	8.67	5.57	9.17	5.07
MW-76C	PAS	14.430	9.80	4.63	9.13	5.30	8.93	5.50
MW-77A	MM/LS	21.780	18.02	3.76	NA	NA	15.69	6.09
MW-77B	LS	22.740	18.96	3.78	16.93	5.81	16.73	6.01
MW-78A	LS	15.230	11.34	3.89	9.27	5.96	9.07	6.16
MW-79B	LS	13.040	10.94	2.10	10.46	2.58	10.44	2.60
MW-79C	PAS	12.540	10.37	2.17	10.02	2.52	9.88	2.66
MW-80A	LS	14.220	11.40	2.82	11.00	3.22	10.84	3.38
MW-81A	LS	27.770	8.65	19.12	7.77	20.00	7.13	20.64
MW-82A	LS	79.370	18.95	60.43	19.20	60.17	17.76	61.61
MW-83A	LS	28.040	5.68	22.36	5.57	22.47	5.41	22.63
MW-84A	LS	28.670	11.40	17.27	11.26	17.41	11.08	17.59
MW-85A	LS	23.430	11.69	11.74	11.50	11.93	11.31	12.12
MW-86A	LS	17.690	8.73	8.96	8.51	9.18	8.51	9.18
MW-86C	PAS	17.560	7.15	10.41	6.63	10.93	8.59	8.97
MW-87A	LS	73.610	22.36	51.25	22.67	50.94	22.56	51.05
MW-87C	PAS	73.960	27.18	46.78	27.35	46.61	27.41	46.55
MW-88A	LS	60.260	14.17	46.09	14.16	46.10	14.13	46.13
MW-88C	PAS	60.620	21.50	39.12	21.58	39.04	21.47	39.15
MW-89A	US/MM/LS	26.890	8.01	18.88	5.67	21.22	5.33	21.56
MW-89C	PAS	27.060	8.94	18.12	8.60	18.46	8.53	18.53
MW-90A	LS	7.650	7.94	-0.29	5.72	1.93	5.75	1.90
MW-90B	LS	7.690	8.00	-0.31	5.75	1.94	5.84	1.85
MW-90C	PAS	7.510	61.87	-54.36	6.36	1.15	5.99	1.52
MW-91A	LS	7.140	5.70	1.44	5.10	2.04	5.18	1.96

See notes on Page 4 of 4.

TABLE 3-13
SUMMARY OF GROUNDWATER AND SURFACE WATER LEVEL MONITORING PROGRAM
ROUNDS 1, 2 AND 3
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL/STAFF GAUGE ID #	HYDROLOGIC UNIT	TOP OF INNER PVC CASING ELEVATION (FT. MSL)	WATER LEVEL MEASUREMENTS AND ELEVATIONS					
			ROUND 1		ROUND 2		ROUND 3	
			DEPTH TO WATER (Ft. Below TOC) 3-Nov-94	WATER ELEVATION (FT. MSL) 3-Nov-94	DEPTH TO WATER (Ft. Below TOC) 19-Jan-95	WATER ELEVATION (FT. MSL) 19-Jan-95	DEPTH TO WATER (Ft. Below TOC) 16-Mar-95	WATER ELEVATION (FT. MSL) 16-Mar-95
MW-91B	LS	6.830	5.47	1.36	4.44	2.39	4.52	2.31
MW-92B	LS	6.580	6.70	-0.12	6.41	0.17	6.35	0.23
MW-93A	LS	7.470	7.28	0.19	6.58	0.89	6.40	1.08
MW-93B	LS	7.290	7.24	0.05	6.42	0.87	6.36	0.93
MW-94A	MM/LS	5.930	4.26	1.67	NA	NA	4.17	1.76
MW-95A	MM	4.190	2.25	1.94	3.04	1.15	2.18	2.02
MW-96A	LS	7.220	8.78	-1.56	6.63	0.59	NA	NA
MW-96C	PAL	7.650	8.97	-1.32	7.69	-0.04	7.13	0.52
MW-97A	LS	7.920	7.40	0.52	6.14	1.78	6.53	1.39
MW-97B	LS	8.890	8.61	0.28	7.34	1.55	7.64	1.25
MW-98A	LS	8.900	7.20	1.70	5.60	3.30	6.41	2.49
MW-98B	LS	8.680	7.00	1.68	5.44	3.24	6.40	2.28
MW-99A	LS	9.520	7.93	1.59	6.79	2.73	7.91	1.61
MW-99B	LS	9.980	8.38	1.60	7.32	2.66	8.36	1.62
MW-100A	US	9.660	5.55	4.11	3.92	5.74	3.75	5.91
MW-101A	LS	9.060	10.48	-1.42	6.36	2.70	9.42	-0.36
MW-103A	LS	82.960	22.16	60.80	21.95	61.01	21.59	61.37
MW-103C	PAS	82.960	20.09	62.88	20.05	62.91	19.98	62.98
MW-104A	LS	89.030	28.36	60.67	29.30	59.73	29.16	59.87
MW-104C	PAS	88.810	29.16	59.65	29.40	59.41	29.51	59.30
MW-105A	LS	92.500	32.58	59.92	33.10	59.40	33.05	59.45
MW-105C	PAS	92.660	33.45	59.21	33.38	59.28	33.31	59.35
MW-EPA-1A	--	49.803	5.36	44.44	4.77	45.03	4.43	45.37
MW-EPA-2A	--	53.315	11.56	41.76	10.85	42.47	10.37	42.95
MW-EPA-3A	--	91.450	34.34	57.11	35.14	56.31	35.42	56.03
MW-EPA-4A	--	71.557	18.59	52.97	19.10	52.46	19.20	52.36
MW-EPA-5A	--	64.289	11.75	52.54	12.30	51.99	12.47	51.82
MW-EPA-6A	--	78.433	22.53	55.90	24.15	54.28	24.22	54.21
MW-EPA-7A	--	78.108	23.10	55.01	23.70	54.41	23.78	54.33
MW-EPA-8A	--	97.098	37.17	59.93	37.90	59.20	37.77	59.33
MW-SA4	--	56.074	17.11	38.96	16.58	39.49	16.21	39.86
MW-SA5	--	39.426	11.07	28.36	10.79	28.64	10.56	28.87
MW-SPCI4	--	43.748	8.99	34.76	8.56	35.19	8.30	35.45
OB-01B	LS	12.040	9.96	2.08	9.53	2.51	9.47	2.58
OB-02B	LS	12.090	9.98	2.11	10.56	1.53	9.49	2.60
OB-03B	LS	12.950	10.86	2.09	10.41	2.54	10.34	2.61
OB-04B	LS	11.180	9.96	1.22	8.64	2.54	8.58	2.60
OB-05A	US	12.370	7.37	5.00	4.87	7.50	4.41	7.96
SG-1	Raritan River	8.584	> 7.49	> 1.09	NA	NA	5.22	3.36
SG-2	Raritan River	3.859	> 4.96	> -1.10	1.06	2.80	NA	NA
SG-3	West Ditch	7.954	> 7.83	> 0.12	5.56	2.39	5.57	2.39
SG-4	West Ditch	4.234	7.79	-3.56	6.67	-2.43	5.38	-1.14
SG-5	ORRC	7.25	5.36	1.89	5.15	2.10	4.99	2.26
SG-6	RRC	7.03	6.57	0.46	4.72	2.31	6.96	0.07
SG-7	Area 16 Ponds	6.351	3.24	3.11	2.79	3.56	3.00	3.35
SG-8	Central Ditch	7.779	4.64	3.14	4.07	3.71	4.23	3.55
SG-9	RRC	6.63	5.95	0.68	3.44	3.19	5.81	0.82
SG-10	Black Ditch	7.285	7.69	-0.41	3.65	3.63	7.06	0.23

See notes on Page 4 of 4.

TABLE 3-13
SUMMARY OF GROUNDWATER AND SURFACE WATER LEVEL MONITORING PROGRAM
ROUNDS 1, 2 AND 3
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL/STAFF GAUGE ID #	HYDROLOGIC UNIT	TOP OF INNER PVC CASING ELEVATION (FT. MSL)	WATER LEVEL MEASUREMENTS AND ELEVATIONS					
			ROUND 1		ROUND 2		ROUND 3	
			DEPTH TO WATER (Ft. Below TOC) 3-Nov-94	WATER ELEVATION (FT. MSL) 3-Nov-94	DEPTH TO WATER (Ft. Below TOC) 19-Jan-95	WATER ELEVATION (FT. MSL) 19-Jan-95	DEPTH TO WATER (Ft. Below TOC) 16-Mar-95	WATER ELEVATION (FT. MSL) 16-Mar-95
SG-11	Black Ditch	7.696	> 5.66	> 2.04	3.96	3.74	5.65	2.05
SG-12	Area 18B Stream	33.196	4.16	29.04	4.37	28.83	4.36	28.84
SG-13	ORRC	4.711	2.83	1.88	2.52	2.19	2.60	2.12
SG-14	Area 18B Stream	26.087	5.08	21.01	5.40	20.69	5.43	20.66
SG-15	Black Ditch	5.893	2.40	3.49	1.84	4.06	2.66	3.23
SG-16	Area 8 Ponds	7.595	4.14	3.46	4.13	3.47	4.14	3.45
SG-17	ORRC	5.466	2.65	2.82	2.59	2.88	2.59	2.88

Notes:
US - Upper Sand
LS - Lower Sand
MM - Meadowmat
RRC - Red Root Creek
ORRC - Old Red Root Creek
NM - Not Measured
Ft. MSL - Feet Mean Sea Level
Ft. Below TOC - Feet below Top Of Inner PVC Casing
The surface water feature, in which a staff gauge is located, is listed in the Hydrologic Unit column.
Elevation data are presented in National Geodetic Vertical Datum (NGVD) of 1929.
NA - Not Available due to malfunction of Well Sentinel during Tidal Influence Investigation.
WBK - Weathered Bedrock Group. The well screen extends into the Raritan Fire Clay Unit and the weathered Passaic Unit.
> - Staff gauge was dry at time of water level monitoring event. Value reported is depth to streambed from top of Staff gauge.
8.01 - Due to possible measurement error, this reading is suspect when compared with the other two rounds of GW level monitoring.

TABLE 3-14
SUMMARY OF TIDAL INFLUENCE INVESTIGATION
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Tidal Influence Monitoring Event	Staff Gauge/ Monitoring Well I.D.	Drainage Area	Type of Monitoring Device	Elevation Measuring Point (FT MSL)	Depth to Water (FT)	Water Elevation At Start of Test (FT MSL)	Date Test Started	Time Test Started	Date Test Ended	Time Test Ended	Comments
Round 1	BP-1	NA	HT	N/A	N/A	N/A	17-Jan-95	9:27	20-Jan-95	9:11	Barometric Pressure Transducer
	SG-1	5	WS	8.55	7.59	0.96	17-Jan-95	16:45	20-Jan-95	9:11	Dry, Depth to stream bed from top of SG= 7.59 ft. Salinity 3 ppt
	SG-2	3	WS	3.86	0.70	3.16	18-Jan-95	10:10	20-Jan-95	16:56	High tide, Salinity 9.8 ppt
	SG-4	6	WS	4.23	> 8.29	4.23	17-Jan-95	16:20	20-Jan-95	12:46	Low tide, Depth to stream bed from top of SG = 8.60, Salinity 9.5
	SG-5	6	WS	7.25	5.18	2.07	18-Jan-95	14:55	20-Jan-95	11:45	Salinity 5.0 Depth to streambed from top of SG = 7.40
	SG-8	4	WS	7.78	4.31	3.47	18-Jan-95	11:00	20-Jan-95	16:51	Salinity = 11 ppt Depth to streambed = 5.60
	SG-9	3	WS	6.63	5.22	1.41	17-Jan-95	12:35	20-Jan-95	15:31	Salinity = Depth to streambed = 8.22
	SG-10	2	WS	7.29	> 7.82	7.29	18-Jan-95	15:20	20-Jan-95	10:09	Salinity = 7 ppt Dry, Depth to streambed = 7.82
	SG-11	6	WS	7.70	> 6.44	7.70	17-Jan-95	14:45	20-Jan-95	9:57	Salinity = 0.9 ppt Dry, Depth to streambed = 6.41
	SG-13	2	WS	4.71	7.57	-2.86	18-Jan-95	12:35	20-Jan-95	12:05	Salinity = 9 ppt Depth to streambed = 4.75
	SG-15	2	WS	5.89	2.64	3.25	17-Jan-95	14:25	20-Jan-95	11:28	Salinity 0.5 ppt Depth to streambed = 3.66
	SG-16	3	HT	7.60	4.12	3.48	17-Jan-95	9:27	20-Jan-95	9:11	Salinity = 0 ppt

TABLE 3-14
SUMMARY OF TIDAL INFLUENCE INVESTIGATION
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Tidal Influence Monitoring Event	Staff Gauge/ Monitoring Well I.D.	Drainage Area	Type of Monitoring Device	Elevation Measuring Point (FT MSL)	Depth to Water (FT)	Water Elevation At Start of Test (FT MSL)	Date Test Started	Time Test Started	Date Test Ended	Time Test Ended	Comments
Round 1 (Continued)	SG-17	6	WS	5.47	2.59	2.88	18-Jan-95	16:05	20-Jan-95	16:29	Salinity = 0 ppt
	MW-50A	1	WS	13.20	4.50	8.70	17-Jan-95	11:07	20-Jan-95	10:26	Upper Sand
	MW-50C	1	WS	12.90	10.16	2.74	17-Jan-95	11:05	20-Jan-95	10:25	Bedrock
	MW-60	5	WS	8.69	3.88	4.81	17-Jan-95	15:45	20-Jan-95	12:37	Upper Sand
	MW-60C	5	WS	8.33	6.70	1.63	17-Jan-95	15:50	20-Jan-95	12:36	Bedrock
	MW-61	3	WS	12.79	8.72	4.07	17-Jan-95	13:55	20-Jan-95	9:38	Upper Sand/Meadowmat/Lower Sand
	MW-76B	2	WS	14.24	8.75	5.49	16-Jan-95	12:40	20-Jan-95	9:04	Lower Sand
	MW-76C	2	WS	14.24	8.75	5.49	16-Jan-95	12:40	20-Jan-95	9:04	Lower Sand
	MW-77A	1	WS	21.78	18.00	3.78	18-Jan-95	15:35	18-Jan-95	15:57	Lower Sand
	MW-79B	3	HT	13.04	10.48	2.56	17-Jan-95	9:27	20-Jan-95	9:11	Lower Sand
	MW-79C	3	HT	12.54	10.02	2.52	17-Jan-95	9:27	20-Jan-95	9:11	Bedrock
	OB-05A	3	HT	12.37	5.05	7.32	17-Jan-95	9:27	20-Jan-95	9:11	Upper Sand
	MW-80A	6	HT	14.22	11.00	3.22	17-Jan-95	13:50	20-Jan-95	9:27	Lower Sand
	MW-90A	6	WS	7.65	5.69	1.96	18-Jan-95	12:25	20-Jan-95	12:05	Lower Sand

TABLE 3-14
SUMMARY OF TIDAL INFLUENCE INVESTIGATION
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Tidal Influence Monitoring Event	Staff Gauge/ Monitoring Well I.D.	Drainage Area	Type of Monitoring Device	Elevation Measuring Point (FT MSL)	Depth to Water (FT)	Water Elevation At Start of Test (FT MSL)	Date Test Started	Time Test Started	Date Test Ended	Time Test Ended	Comments
Round 1 (Continued)	MW-93A	4	WS	7.47	6.62	0.85	18-Jan-95	11:20	20-Jan-95	12:24	Lower Sand
	MW-94A	3	WS	5.93	3.61	2.32	16-Jan-95	12:45	16-Jan-95	13:38	Meadowmat/Lower Sand
	MW-96A	3	WS	7.22	8.21	-0.99	17-Jan-95	13:15	20-Jan-95	9:36	Lower Sand
	MW-96C	3	WS	7.65	7.82	-0.17	17-Jan-95	13:07	20-Jan-95	9:38	Bedrock
	MW-99A	2	WS	9.52	7.58	1.94	17-Jan-95	15:15	20-Jan-95	9:42	Lower Sand
Round 2	BP-1	NA	HT	N/A	N/A	N/A	13-Mar-95	17:20	17-Mar-95	8:18	Barometric Pressure Transducer
	SG-2	3	WS	3.86	2.46	1.40	15-Mar-95	17:05	17-Mar-95	8:10	Salinity = 6.5 ppt
	SG-4	6	WS	4.23	9.05	-4.82	14-Mar-95	9:55	17-Mar-95	17:20	Salinity = 6 ppt
	SG-5	6	WS	7.25	5.22	2.03	14-Mar-95	11:35	17-Mar-95	10:09	Salinity = 0.2 ppt
	SG-6	3	WS	6.35	10.42	-4.07	14-Mar-95	15:40	17-Mar-95	13:11	Salinity = 4.5
	SG-8	4	WS	7.78	4.46	3.32	13-Mar-95	16:20	17-Mar-95	10:41	Salinity = 3 ppt
	SG-9	3	WS	6.63	10.25	-3.62	14-Mar-95	14:20	17-Mar-95	13:35	Salinity = 1.5 ppt, Dry Depth to bottom 10.25
	SG-10	2	WS	7.29	10.13	-2.85	13-Mar-95	12:50	17-Mar-95	14:10	Salinity = 0 ppt, Low tide, Dry

TABLE 3-14
SUMMARY OF TIDAL INFLUENCE INVESTIGATION
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Tidal Influence Monitoring Event	Staff Gauge/ Monitoring Well I.D.	Drainage Area	Type of Monitoring Device	Elevation Measuring Point (FT MSL)	Depth to Water (FT)	Water Elevation At Start of Test (FT MSL)	Date Test Started	Time Test Started	Date Test Ended	Time Test Ended	Comments
Round 2 (Continued)	SG-11	2	WS	7.70	8.70	-1.00	13-Mar-95	13:20	17-Mar-95	14:15	Salinity = 0 ppt, Low tide
	SG-13	6	WS	4.71	2.83	1.88	14-Mar-95	11:10	17-Mar-95	14:37	Salinity = 1.5 ppt
	SG-15	2	WS	5.89	5.72	0.17	13-Mar-95	15:00	17-Mar-95	11:06	Salinity = 0 ppt
	SG-16	3	HT	7.60	7.18	0.42	13-Mar-95	17:20	17-Mar-95	8:18	Salinity = 0.5 ppt
	SG-17	6	WS	5.47	5.64	-0.17	14-Mar-95	12:00	17-Mar-95	10:00	Salinity = 0 ppt
	MW-50A	1	WS	13.20	8.49	4.71	13-Mar-95	14:30	17-Mar-95	8:38	Upper Sand
	MW-50C	1	WS	12.90	13.22	-0.32	13-Mar-95	14:15	17-Mar-95	8:41	Bedrock
	MW-60	5	WS	8.69	7.07	1.62	14-Mar-95	10:30	17-Mar-95	15:49	Upper Sand
	MW-60C	5	WS	8.33	9.82	-1.49	14-Mar-95	10:20	17-Mar-95	15:47	Bedrock
	MW-61	3	WS	12.79	11.78	1.01	13-Mar-95	16:30	17-Mar-95	14:48	---
	MW-76B	2	WS	13.84	11.83	2.01	13-Mar-95	12:20	17-Mar-95	8:03	Lower Sand
	MW-76C	2	WS	14.43	12.04	2.39	13-Mar-95	12:30	17-Mar-95	8:02	Bedrock

TABLE 3-14
SUMMARY OF TIDAL INFLUENCE INVESTIGATION
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Tidal Influence Monitoring Event	Staff Gauge/ Monitoring Well I.D.	Drainage Area	Type of Monitoring Device	Elevation Measuring Point (FT MSL)	Depth to Water (FT)	Water Elevation At Start of Test (FT MSL)	Date Test Started	Time Test Started	Date Test Ended	Time Test Ended	Comments
Round 2 (Continued)	MW-77A	1	WS	21.78	18.65	3.13	13-Mar-95	15:20	17-Mar-95	12:45	Upper Sand
	MW-79B	3	HT	13.04	13.50	-0.46	13-Mar-95	17:20	17-Mar-95	8:18	Lower Sand
	MW-79C	3	HT	12.54	12.95	-0.41	13-Mar-95	17:20	17-Mar-95	8:18	Bedrock
	OB-05A	3	HT	12.37	7.50	4.87	13-Mar-95	17:20	17-Mar-95	8:18	Upper Sand
	MW-80A	6	WS	14.22	13.90	0.32	14-Mar-95	13:00	17-Mar-95	9:53	Lower Sand
	MW-90A	6	WS	7.65	8.90	-1.25	14-Mar-95	10:55	17-Mar-95	14:40	Lower Sand
	MW-91A	6	WS	7.14	1.96	2.34	14-Mar-95	16:05	17-Mar-95	14:28	Lower Sand
	MW-93A	4	WS	7.47	9.60	-2.13	14-Mar-95	15:05	17-Mar-95	10:14	Lower Sand
	MW-94A	3	WS	5.93	7.29	-1.36	14-Mar-95	14:10	17-Mar-95	13:42	Meadowsand/Lower Sand
	MW-96A	3	WS	7.22	10.65	-3.43	13-Mar-95	15:50	17-Mar-95	14:02	Upper Sand/Meadowmat/Lower Sand
	MW-96C	3	WS	7.65	11.57	-3.92	13-Mar-95	16:00	17-Mar-95	14:01	Bedrock
	MW-99A	2	WS	9.52	11.07	-1.55	14-Mar-95	15:30	17-Mar-95	14:08	Lower Sand

1 Pretest performed at these locations from (DATES & TIME)
2 Drainage area refers to one of the eight drainage areas identified on site.
See Section 4.6 and Figure 4-?.
WS = In site well sentinal data logger with a PD-? pressure transducer
HT = Hermit SE-2000? Data logger with a PD-__ pressure transducer
FT MSL

TABLE 4-1
SUMMARY OF GEOTECHNICAL SOIL SAMPLING RESULTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Sample ID:	Sample Depth (ft. BGS)	Date Sample Collected	Sample Collected From	Moisture Content (%)	Specific Gravity	USCS Identification	ATTERBERG LIMITS (LL/PL/PI)	TRIAXIAL PERMEABILITY (ASTM 5084 Hydraulic Conductivity)					
								Void Ratio	Porosity (%)	Pore Volume [CC]	Degree of Saturation (%)	Hydraulic Conductivity [cm/s] (1)	Intrinsic Permeability [darcys] (1)
SS-1713A	0.0-2.0	10/15/93	US	14.50	2.42	ML/CL	27.0/20.6/6.4	0.57	36.1	105	68.2	1.71 E-07	1.74 E-03
SS-1713C	4.0-6.0	10/16/93	US	4.90	2.71	SM	Non-Plastic Non-Cohesive	0.68	40.6	136	19.6	1.07 E-05	1.09 E-01
SS-0326A	0.0-2.0	7/18/94	US	11.40	2.71	SM	Non-Plastic Non-Cohesive	0.73	42.3	86	42.0	6.27 E-05	6.50 E-02
SS-0334B	10.0-12.0	7/20/94	US	12.20	2.79	ML	45.0/35.4/9.6	0.64	39.1	33	52.8	2.25 E-06	2.33 E-03
SS-0405A	0.0-2.0	4/25/94	US	12.90	2.68	SM	Non-Plastic	0.64	39.0	106	53.9	2.31E-05	2.40E-02
SS-0405B	2.0-4.0	4/25/94	US	17.50	2.69	SM	Non-Plastic	0.65	39.5	95	72.3	1.72E-06	1.79E-03
SS-0611A	0.0-2.0	9/1/94	US	48.50	2.71	MH	51.6/37.7/13.9	1.66	62.4	123	79.4	2.94 E-07	3.05 E-04
SS-0613B	0.0-2.0	9/2/94	US	55.50	2.68	MH	62.7/44.2/18.5	2.01	66.8	122	73.8	4.78 E-07	4.96 E-04
SS-06A01A	0.0-2.0	7/29/94	US	47.50	2.75	SM	32.8/31.4/1.4	1.37	57.8	109	95.3	3.95 E-06	4.10 E-03
SS-06A08A	0.0-2.0	7/29/94	US	9.60	2.78	SM	19.7/19.6/0.1	0.67	40.0	57	39.9	8.90 E-05	9.23 E-02
SS-0703B	3.0-5.0	7/25/94	US	13.0	2.67	SP/SM	Non-Plastic Non-Cohesive	0.56	35.9	25	62.2	2.88 E-06	2.99 E-03
SS-0705A	1.0-3.0	7/25/94	US	12.1	2.73	SM	Non-Plastic Non-Cohesive	0.50	33.2	59	66.4	2.99 E-06	3.10 E-03
SS-0801B	5.0-7.0	7/26/94	US	12.3	2.72	SM	17.6/17.6/0.0	0.54	35.1	59	62.0	1.71 E-05	1.77 E-02
SS-0802A	2.0-4.0	7/26/94	US	12.0	2.70	SM	17.7/17.7/0.0	0.50	33.2	59	65.0	2.13 E-05	2.21 E-02
SS-0901A	1.0-3.0	7/26/94	US	14.1	2.67	SC	24.1/15.8/8.3	0.60	37.4	50	63.2	8.60 E-07	8.92 E-04
SS-0902B	4.0-6.0	7/27/94	US	17.2	2.72	SM	Non-Plastic Non-Cohesive	0.51	33.8	60	91.7	3.78 E-06	3.92 E-03
SS-1001A	0.0-2.0	4/22/94	US	35.90	2.66	ML	47.4/36.3/11.1	1.08	52.0	110	88.3	4.90 E-06	5.08 E-03
SS-1001B	4.0-5.0	4/22/94	US	10.80	2.68	SM	Non-Plastic Non-Cohesive	0.54	35.0	100	54.0	4.83 E-04	5.01 E-01
SS-1002A	0.0-2.0	4/22/94	US	27.40	2.62	ML	35.3/29.6/5.7	0.86	46.3	110	83.4	1.56 E-05	1.62 E-02
SS-1101A	0.0-2.0	10/5/94	US	64.3	2.71	MH	52.1/40.5/11.6	1.60	61.6	112	108.5	3.74 E-07	3.88 E-04
SS-1106A	0.0-2.0	10/6/94	US	7.5	2.77	SP	Non-Plastic Non-Cohesive	0.63	38.7	63	32.8	4.59 E-04	4.76 E-01
SS-11807A	4.0-6.0	4/15/94	US	5.60	2.74	SP/SM	Non-Plastic Non-Cohesive	0.62	38.4	120	24.5	1.21E-03	1.25E+00
SS-11809A	4.0-6.0	4/18/94	US	7.80	2.73	SP/SM	Non-Plastic Non-Cohesive	0.52	34.2	92	40.7	1.9 E-04	1.97 E-01
SS-1410A	2.0-4.0	7/12/94	US	77.80	2.63	MH	81.5/72.9/8.6	2.34	70.0	57	87.5	4.02 E-06	4.17 E-03
SS-16138A	0.0-2.0	8/24/94	US	9.80	2.74	SM	Non-Plastic Non-Cohesive	0.52	34.4	54	51.5	8.66 E-07	8.98 E-04
SS-1636A	4.0-6.0	8/11/94	US	18.30	2.62	ML/CL	22.2/15.5/6.7	0.53	34.5	53	91.1	7.03 E-08	7.30 E-05
SS-1688A	2.0-4.0	8/18/94	US	10.40	2.70	SM	Non-Plastic Non-Cohesive	0.49	32.7	44	57.5	1.63 E-06	1.69 E-03
SS-1696A	2.0-4.0	8/18/94	US	20.10	2.72	CL	31.8/21.3/10.5	0.63	38.5	49	87.4	1.39 E-07	1.44 E-04
SS-18A03A	0.0-2.0	4/14/94	US	21.70	2.73	SM	24.3/21.6/2.7	0.58	36.8	67	101.6	6.19E-07	6.42E-04
SS-18A11A	0.0-2.0	5/4/94	US	13.50	2.76	SW/SM	Non-Plastic Non-Cohesive	0.59	37.2	104	63.0	1.14E-04	1.18E-01
SS-18A11B	2.0-4.0	5/4/94	US	18.20	2.67	SP/SM	Non-Plastic Non-Cohesive	0.59	37.3	117	81.8	5.89E-07	6.11E-04
SS-18A13A	0.0-2.0	5/5/94	US	8.80	2.64	SM	18.5/18.5/0.0	0.61	37.8	46	38.3	1.45E-05	1.50E-02
SS-18A21A	0.0-2.0	5/5/94	US	13.90	2.71	SM	21.8/21.0/0.8	0.48	32.4	44	78.9	4.33E-06	4.49E-03
SS-18A22A	0.0-2.0	5/5/94	US	5.30	2.71	SW/SM	Non-Plastic Non-Cohesive	0.49	33.1	68	28.7	3.96E-05	4.11E-02
SS-18A22B	4.0-6.0	5/5/94	US	11.20	2.66	SM	16.2/14.7/1.5	0.43	30.2	36	68.6	9.55E-08	9.91E-05
SS-18A24A	0.0-2.0	5/13/94	US	13.30	2.71	SM	18/18/0.0	0.59	37.0	82	61.2	2.34 E-07	2.42 E-04
SS-1934A	0.0-2.0	8/2/94	US	10.20	2.63	SM	Non-Plastic Non-Cohesive	0.56	36.0	84	47.8	5.72 E-06	5.93 E-03
SS-1934B	3.0-5.0	8/2/94	US	10.10	2.64	SM	16.5/15.1/1.4	0.45	31.2	78	58.9	2.88 E-06	2.98 E-03

NOTES: See page 3 of 3.

TABLE 4-1
SUMMARY OF GEOTECHNICAL SOIL SAMPLING RESULTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Sample ID:	Sample Depth (ft. BGS)	Date Sample Collected	Sample Collected From	Moisture Content (%)	Specific Gravity	USCS Identification	ATTERBERG LIMITS (LL/PL/PI)	TRIAXIAL PERMEABILITY (ASTM 5084 Hydraulic Conductivity)					
								Void Ratio	Porosity (%)	Pore Volume [CC]	Degree of Saturation (%)	Hydraulic Conductivity [cm/s] (1)	Intrinsic Permeability [darcys] (1)
SS-1937B (2)	4.0-6.0	8/2/94	US	NA	2.78	SM or SC	NA	NA	NA	NA	NA	NA	NA
SS-1949B	3.0-5.0	7/27/94	US	15.10	2.73	SM	17.8/17.8/0.0	0.63	38.6	38.6	65.4	1.33 E-06	1.38 E-03
SS-1951A	0.0-2.0	7/27/94	US	12.00	2.72	SM	Non-Plastic Non-Cohesive	0.68	40.5	61	48.0	4.84 E-06	5.02 E-03
SS-OWO3A	0.0-2.0	8/3/94	US	12.30	2.64	SM/SC	26.7/20.1/6.6	0.78	43.8	76	41.7	1.80 E-06	1.87 E-03
SS-W04A	2.0-4.0	4/13/94	US	10.00	2.71	SM	2.8	0.60	37.3	136	45.7	4.19E-04	4.34E-01
SS-W05A	0.0-2.0	4/13/94	US	10.50	2.58	SM	Non-Plastic	0.44	30.5	48	61.8	2.06E-05	2.13E-02
MW-91B	6.0-8.0	8/9/94	MM	138.30	2.71	SM	31.7/28.8/2.9	2.45	71.0	130	152.7	1.11E-07	1.15E-04
MW-96C	10.0-12.0	9/2/94	MM	71.20	2.68	MH	68.0/44.4/23.6	1.98	66.5	166	96.3	9.68E-08	1.00E-04
MW-96C	30.0-32.0	9/2/94	MM	77.00	2.67	MH	64.0/49.5/14.5	2.00	66.7	138	102.8	3.44E-08	3.56E-05
MW-98A	7.0-9.0	9/14/94	MM	15.40	2.69	SM	Non-Plastic Non-Cohesive	0.48	32.3	65	86.9	1.37E-06	1.42E-03
SS-0324B	2.0-4.0	7/18/94	MM	25.70	2.70	SM	Non-Plastic Non-Cohesive	1.01	50.3	43	68.3	3.68 E-08	3.82 E-05
SS-1410B	6.0-8.0	7/12/94	MM	119.80	2.77	MH	80.0/45.5/34.5	3.19	76.1	118	104.0	8.54 E-08	8.86 E-05
SS-1429A	0.0-2.0	7/11/94	MM	60.40	2.71	MH	70.7/62.9/7.8	1.93	65.9	66	84.4	1.24E-04	1.29E-01
SS-1429B	4.0-6.0	7/11/94	MM	67.70	2.78	MH	74.6/66.9/7.7	2.27	69.4	84	82.9	1.78E-07	1.84E-04
SS-1713D	26-28	10/17/93	LS	16.50	2.67	CL	25.4/15.9/9.5	0.49	32.7	86	90.3	2.01 E-07	2.04 E-03
MW-76B	26.5-28.5	5/16/94	LS	41.80	2.73	MH	90.4/62.8/27.6	1.15	53.6	99	98.6	6.88E-08	7.14E-05
SS-0201A	0.0-2.0	7/15/94	LS	9.50	2.76	SM	Non-Plastic Non-Cohesive	0.55	35.6	59	47.7	1.32 E-05	1.37 E-02
SS-0202B	2.0-4.0	7/15/94	LS	10.20	2.69	SM	Non-Plastic Non-Cohesive	0.53	34.6	59	51.9	1.16 E-04	1.20 E-01
SS-0203C	8.0-10.0	7/15/94	LS	11.90	2.79	SP/SM	Non-Plastic Non-Cohesive	0.62	38.4	74	53.1	8.38 E-05	8.69 E-02
SS-0207B	4.0-6.0	7/15/94	LS	5.70	2.76	SM	Non-Plastic Non-Cohesive	0.56	35.9	27	28.0	1.95 E-05	2.02 E-02
SS-0211C	9.0-11.0	7/14/94	LS	16.90	2.72	SP/SM	Non-Plastic Non-Cohesive	0.42	29.5	39	110.1	3.61 E-04	3.74 E-01
SS-0321A	0.0-2.0	7/19/94	LS	7.20	2.71	SM	Non-Plastic Non-Cohesive	0.60	37.7	58	28.6	2.65 E-04	2.75 E-01
SS-0327B	4.0-6.0	7/18/94	LS	8.10	2.73	SM	19.9/16.6/3.3	0.39	28.0	65	56.8	1.78 E-05	1.85 E-02
SS-0328B	4.0-6.0	7/18/94	LS	13.40	2.82	SM	40.8/28.2/12.6	0.71	41.5	59	53.2	4.32 E-04	4.48 E-01
SS-1002B	4.0-6.0	4/22/94	LS	12.00	2.81	SP/SM	Non-Plastic Non-Cohesive	0.36	26.6	76	90.0	3.93 E-04	4.08 E-01
SS-11802A	4.0-6.0	4/18/94	LS	6.20	2.71	SM	Non-Plastic Non-Cohesive	0.46	31.4	93	36.4	2.14 E-04	2.22 E-01
SS-11807B	8.0-10.0	4/15/94	LS	14.00	2.67	SM	Non-Plastic Non-Cohesive	0.66	39.7	126	56.7	4.19E-04	4.35E-01
SS-1607A	4.0-6.0	8/8/94	LS	19.10	2.67	SW/SM	Non-Plastic Non-Cohesive	1.06	51.4	71	48.2	9.89 E-05	1.03 E-01
SS-18A03B	8.0-10.0	4/14/94	LS	12.20	2.75	SM	Non-Plastic Non-Cohesive	0.46	31.7	80	72.3	1.85E-07	1.92E-04
SS-18A03C	10.0-12.0	4/14/94	LS	17.40	2.76	SM	Non-Plastic Non-Cohesive	0.62	38.4	94	76.9	1.27E-05	1.31E-02
SS-18A11C	4.0-6.0	5/4/94	LS	3.40	2.66	SP/SM	Non-Plastic Non-Cohesive	0.66	39.6	127	13.8	6.78E-05	7.03E-02
SS-18A13B	4.0-6.0	5/5/94	LS	3.90	2.64	SP	Non-Plastic Non-Cohesive	0.53	34.7	68	19.5	7.50E-04	7.78E-01
SS-18A13C	8.0-10.0	5/5/94	LS	11.00	2.67	SW/SM or SW/SC	Non-Plastic Non-Cohesive	0.50	33.4	80	73.2	2.25E-07	2.33E-04
SS-18A21B	4.0-6.0	5/5/94	LS	17.50	2.68	SM	18.7/15.6/3.0	0.50	33.3	46	93.7	3.23E-06	3.35E-03
SS-18A23B	2.0-4.0	5/5/94	LS	13.20	2.72	SM	Non-Plastic Non-Cohesive	0.46	31.5	42	78.1	1.64E-05	1.70E-02
SS-OW03B	8.0-10.0	8/3/94	LS	9.0	2.69	SM	Non-Plastic Non-Cohesive	0.33	25.1	37	71.8	3.58 E-06	3.71 E-03
SS-OW03C	14.0-16.0	8/3/94	LS	11.80	2.73	SM	Non-Plastic Non-Cohesive	0.49	32.8	54	65.9	8.51 E-07	8.82 E-04

NOTES: See page 3 of 3.

TABLE 4-1
SUMMARY OF GEOTECHNICAL SOIL SAMPLING RESULTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Sample ID:	Sample Depth (ft. BGS)	Date Sample Collected	Sample Collected From	Moisture Content (%)	Specific Gravity	USCS Identification	ATTERBERG LIMITS (LL/PL/PI)	TRIAXIAL PERMEABILITY (ASTM 5084 Hydraulic Conductivity)					
								Void Ratio	Porosity (%)	Pore Volume [CC]	Degree of Saturation (%)	Hydraulic Conductivity [cm/s] (1)	Intrinsic Permeability [darcys] (1)
MW-79B	19.0-21.0	9/29/94	LS	13.7	2.73	SP/SM	Non-Plastic Non-Cohesive	0.58	36.6	80	64.8	2.51 E-06	2.60 E-03
MW-47C	15.0-17.0	8/10/94	WBK	49.60	2.76	MH	70.4/45.5/24.9	1.42	58.6	157	96.6	4.10E-07	4.25E-04
MW-6C	18.0-20.0	9/9/95	WBK	43.90	2.59	MH	51.5/39.8/11.7	1.08	52.0	101	104.8	1.45E-07	1.50E-04
MW-86C	38.0-40.0	8/18/94	WBK	30.80	2.78	SM	62.9/36.1/26.8	1.08	51.9	69	79.3	1.44E-06	1.49E-03
MW-87C	51.0-53.0	9/20/94	WBK	28.00	2.78	MH	54.9/34.7/20.2	0.80	44.5	107	96.9	2.81E-08	2.91E-05
MW-89C	13.0-15.0	9/12/94	WBK	37.60	2.72	CH	64.8/30.3/34.5	1.01	50.2	129	101.7	8.08E-08	8.38E-05
MW-90C	29.0-31.0	08/16/94	WBK	39.10	2.73	CH	113.5/31.2/82.3	1.13	53.0	94	94.8	1.71E-07	1.77E-04
OB01-B	28.0-30.0	9/27/94	WBK	29.00	2.79	ML	45.8/34.7/11.1	0.97	49.3	140	83.1	3.54E-07	3.67E-04

NOTES:
E: Exponential
SM - Silty Sand
LS - Lower Sand
US - Upper Sand
SC - Clayey Sand
NA: Not analyzed
MM - Meadowmat
MH - Inorganic Silt
cc: cubic centimeter
Shelby - Shelby Tube
SP - Poorly Graded Sand
SW - Well Graded Sands

cm/s: centimeter per second
Insert - Stainless Steel Insert
(1) Measured at 20 degrees Celsius.
CH - Inorganic Clay of High Plasticity
CL - Inorganic Clay of Low to Medium Plasticity
(LL/PL/PI) - Liquid Limit/Plastic Limit/Plasticity Index
ML - Inorganic Silt and Very Fine Sand, Low Plasticity
WBK: Weathered Bedrock Group. Represents the Raritan Fire Clay unit and/or the Weathered Passaic unit.
(2) Sample not analyzed for Atterberg Limits, moisture content, or triaxial permeability because of insufficient sample volume in sampling device.
USCS Identification - Unified Soil Classification System determined by laboratory classification based on particle size and physical characteristics testing. Particle size analysis data is presented with the full Geotechnical Reports in Appendix C.

TABLE 4-2
SUMMARY OF HORIZONTAL HYDRAULIC GRADIENTS FOR
OVERBURDEN MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

ROUND 1				Change in Groundwater Level (FT.)	Change in Distance Between Wells (FT.)	Horizontal Hydraulic Gradient 3-Nov-94 (FT/FT)	Hydrologic Zone
NORTHERN MONITORING WELLS		SOUTHERN MONITORING WELLS					
Monitoring Well ID	Groundwater Elevation 3-Nov-94 (FT. MSL)	Monitoring Well ID	Groundwater Elevation 3-Nov-94 (FT. MSL)				
MW-13	19.53	MW-59	6.85	12.68	1725	0.0074	North/South
MW-18	11.48	MW-75A	4.49	6.99	1175	0.0059	North/South
MW-59	6.85	MW-94A	1.67	5.18	3050	0.0017	South
MW-74B	47.24	MW-91B	1.36	45.88	12600	0.0036	North/South
MW-75A	4.49	MW-98A	1.70	2.79	2850	0.0010	South
MW-79B	2.10	MW-93B	0.05	2.05	2900	0.0007	South
MW-80A	2.82	MW-54	0.94	1.88	700	0.0027	South
MW-92B	-0.12	MW-90B	-0.31	0.19	2100	0.0001	South
MW-103A	60.80	MW-40	52.74	8.06	575	0.0140	North
MW-103A	60.80	MW-50B	1.76	59.04	12800	0.0046	North/South
MW-104A	60.67	MW-58	17.61	43.06	3750	0.0115	North
MW-104A	60.67	MW-81A	19.12	41.55	3500	0.0119	North
MW-104A	60.67	MW-100A	4.11	56.56	10600	0.0053	North/South
MW-105A	59.21	MW-6	2.61	56.60	5875	0.0096	North/South
MW-105A	59.92	MW-64	50.37	9.55	2300	0.0042	North
MW-105A	59.92	MW-87A	51.25	8.67	2150	0.0040	North
Average Overburden Horiz. Hydraulic Gradient - Northern Zone						*0.0091*	
Average Overburden Horiz. Hydraulic Gradient - Southern Zone						*0.0012*	
Average Overburden Horiz. Hydraulic Gradient - Northern & Southern						*0.0061*	

NOTES:

NA - Data not available
(FT. MSL) - Feet Mean Sea Level
MSL - Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Hydraulic Gradients calculated as the ratio of change in water level elevation to the change in distance between the two wells.

TABLE 4-2
SUMMARY OF HORIZONTAL HYDRAULIC GRADIENTS FOR OVERBURDEN MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

ROUND 2				Change in Groundwater Level (FT.)	Change in Distance Between Wells (FT.)	Horizontal Hydraulic Gradient 19-Jan-95 (FT/FT)	Hydrologic Zone
NORTHERN MONITORING WELLS		SOUTHERN MONITORING WELLS					
Monitoring Well ID	Groundwater Elevation 19-Jan-95 (FT. MSL)	Monitoring Well ID	Groundwater Elevation 19-Jan-95 (FT. MSL)				
MW-13	20.57	MW-59	7.30	13.27	1725	0.0077	North/South
MW-18	13.07	MW-75A	2.23	10.84	1175	0.0092	North/South
MW-59	7.30	MW-94A	NA	NA	3050	NA	NA
MW-74B	46.92	MW-91B	2.39	44.53	12600	0.0035	North/South
MW-75A	2.23	MW-98A	3.30	-1.07	2850	-0.0004 *	South
MW-79B	2.58	MW-93B	0.87	1.71	2900	0.0006	South
MW-80A	3.22	MW-54	1.24	1.98	700	0.0028	South
MW-92B	0.17	MW-90B	1.94	1.77	2100	0.0008	South
MW-103A	61.01	MW-40	52.55	8.46	575	0.0147	North
MW-103A	61.01	MW-50B	3.79	57.22	12800	0.0045	North/South
MW-104A	59.73	MW-58	18.54	41.19	3750	0.0110	North
MW-104A	59.73	MW-81A	20.00	39.73	3500	0.0114	North
MW-104A	59.73	MW-100A	5.74	53.99	10600	0.0051	North/South
MW-105A	59.40	MW-6	3.71	55.69	5875	0.0095	North/South
MW-105A	59.40	MW-64	50.31	9.09	2300	0.0040	North
MW-105A	59.40	MW-87A	50.94	8.46	2150	0.0039	North
Average Overburden Horiz. Hydraulic Gradient - Northern Zone						***0.0090***	
Average Overburden Horiz. Hydraulic Gradient - Southern Zone						***0.0010***	
Average Overburden Horiz. Hydraulic Gradient - Northern & Southern						***0.0066***	

NOTES:

NA - Data not available
(FT. MSL) - Feet Mean Sea Level
* - Negative value most likely the result of tidal influence.
MSL - Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Hydraulic Gradients calculated as the ratio of change in water level elevation to the change in distance between the two wells.
2.23 - Due to possible measurement error, this reading is suspect when compared with the other two rounds of GW level monitoring.

TABLE 4-2
SUMMARY OF HORIZONTAL HYDRAULIC GRADIENTS FOR OVERBURDEN MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

ROUND 3				Change In Groundwater Level (FT.)	Change In Distance Between Wells (FT.)	Horizontal Hydraulic Gradient 16-Mar-94 (FT/FT)	Hydrologic Zone
NORTHERN MONITORING WELLS		SOUTHERN MONITORING WELLS					
Monitoring Well ID	Groundwater Elevation 16-Mar-95 (FT. MSL)	Monitoring Well ID	Groundwater Elevation 16-Mar-95 (FT. MSL)				
MW-13	21.18	MW-59	7.39	13.79	1725	0.0080	North/South
MW-18	13.53	MW-75A	5.25	8.28	1175	0.0070	North/South
MW-59	7.39	MW-94A	1.76	5.63	3050	0.0018	South
MW-74B	49.06	MW-91B	2.31	46.75	12600	0.0037	North/South
MW-75A	5.25	MW-98A	2.49	2.76	2850	0.0010	South
MW-79B	2.60	MW-93B	0.93	1.67	2900	0.0006	South
MW-80A	3.38	MW-54	1.33	2.05	700	0.0029	South
MW-92B	0.23	MW-90B	1.85	-1.62	2100	-0.0008 *	South
MW-103A	61.37	MW-40	52.97	8.40	575	0.0146	North
MW-103A	61.37	MW-50B	3.39	57.98	12800	0.0045	North/South
MW-104A	59.87	MW-58	19.43	40.44	3750	0.0108	North
MW-104A	59.87	MW-81A	20.64	39.23	3500	0.0112	North
MW-104A	59.87	MW-100A	5.91	53.96	10600	0.0051	North/South
MW-105A	59.45	MW-6	3.78	55.67	5875	0.0095	North/South
MW-105A	59.45	MW-64	50.46	8.99	2300	0.0039	North
MW-105A	59.45	MW-87A	51.05	8.40	2150	0.0039	North
Average Overburden Horiz. Hydraulic Gradient - Northern Zone						***0.0089***	
Average Overburden Horiz. Hydraulic Gradient - Southern Zone						***0.0011***	
Average Overburden Horiz. Hydraulic Gradient - Northern & Southern						***0.0063***	

NOTES:

NA - Data not available
(FT. MSL) - Feet Mean Sea Level
* - Negative value most likely the result of tidal influence.
MSL - Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Hydraulic Gradients calculated as the ratio of change in water level elevation to the change in distance between the two wells.

TABLE 4-3
SUMMARY OF VERTICAL HYDRAULIC GRADIENTS FOR
DEEP VERSUS SHALLOW OVERBURDEN MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

ROUND 1						Change in Groundwater Level (FT.)	Change in Bottom of Well Screen (FT.)	Vertical Hydraulic Gradient 3-Nov-94 (FT/FT)	Trending of Hydraulic Gradient
DEEP OVERBURDEN MONITORING WELLS			SHALLOW OVERBURDENMONITORING WELLS						
Monitoring Well ID	Groundwater Elevation 3-Nov-94 (FT. MSL)	Bottom of Well Screen Elevation (FT. MSL)	Monitoring Well ID	Groundwater Elevation 3-Nov-94 (FT. MSL)	Bottom of Well Screen Elevation (FT. MSL)				
MW-28B	-1.96	59.00	MW-28	3.33	7.00	-5.29	52.00	-0.1017	D
MW-48B	3.18	28.00	MW-48A	3.19	17.00	-0.01	11.00	-0.0009	D
MW-50B	1.76	50.30	MW-50	6.77	12.00	-5.01	38.30	-0.1308	D
MW-52B	1.29	26.50	MW-52A	1.67	12.00	-0.38	14.50	-0.0262	D
MW-55B	40.09	21.00	MW-55A	43.49	9.00	-3.40	12.00	-0.2833	D
MW-60B	0.26	45.20	MW-60	3.24	17.00	-2.98	28.20	-0.1057	D
MW-63	-0.85	55.50	MW-63A	3.32	16.00	-4.17	39.50	-0.1056	D
MW-76B	4.62	26.00	MW-76A	4.56	13.50	0.06	12.50	0.0048	U
MW-79B	2.10	28.00	OB-05A	5.00	9.50	-2.90	18.50	-0.1568	D
MW-90B	-0.31	28.00	MW-90A	-0.29	18.00	-0.02	10.00	-0.0020	D
MW-97B	0.28	55.00	MW-97A	0.52	35.00	-0.24	20.00	-0.0120	D
MW-98B	1.68	52.00	MW-98A	1.70	33.00	-0.02	19.00	-0.0011	D
MW-99B	1.60	39.60	MW-99A	1.59	25.00	0.01	14.60	0.0007	U
Average Vertical Gradient of Deep Overburden Wells Compared to Shallow Overburden Wells								***-0.0708***	
Average Vertical Gradient of Upward Trending Deep Overburden Wells Compared to Shallow Overburden Wells								***0.0027***	
Average Vertical Gradient of Downward Trending Deep Overburden Wells Compared to Shallow Overburden Wells								***-0.0842***	

NOTES:

NA - Data not available
U - Upward Hydraulic Gradient
D - Downward Hydraulic Gradient
(FT. MSL) - Feet Mean Sea Level
MSL - Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Positive Hydraulic Gradients denote an Upward Trending and Negative Hydraulic Gradients denote a Downward Trend.
Hydraulic Gradients calculated as the ratio of change in water level elevation to the change in bottom of screen elevation.

TABLE 4-3
SUMMARY OF VERTICAL HYDRAULIC GRADIENTS FOR
DEEP VERSUS SHALLOW OVERBURDEN MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

ROUND 2						Change in Groundwater Level (FT.)	Change in Bottom of Well Screen (FT.)	Vertical Hydraulic Gradient 19-Jan-95 (FT/FT)	Trending of Hydraulic Gradient
DEEP OVERBURDEN MONITORING WELLS			SHALLOW OVERBURDENMONITORING WELLS						
Monitoring Well ID	Groundwater Elevation 19-Jan-95 (FT. MSL)	Bottom of Well Screen Elevation (FT. MSL)	Monitoring Well ID	Groundwater Elevation 19-Jan-95 (FT. MSL)	Bottom of Well Screen Elevation (FT. MSL)				
MW-28B	2.33	59.00	MW-28	4.08	7.00	-1.75	52.00	-0.0337	D
MW-48B	3.58	28.00	MW-48A	3.58	17.00	0.00	11.00	0.0000	N/A
MW-50B	3.79	50.30	MW-50	8.71	12.00	-4.92	38.30	-0.1285	D
MW-52B	1.87	26.50	MW-52A	2.12	12.00	-0.25	14.50	-0.0172	D
MW-55B	40.63	21.00	MW-55A	45.33	9.00	-4.70	12.00	-0.3917	D
MW-60B	2.52	45.20	MW-60	4.82	17.00	-2.30	28.20	-0.0816	D
MW-63	1.90	55.50	MW-63A	4.51	16.00	-2.61	39.50	-0.0661	D
MW-76B	5.57	26.00	MW-76A	6.12	13.50	-0.55	12.50	-0.0440	D
MW-79B	2.58	28.00	OB-05A	7.50	9.50	-4.92	18.50	-0.2659	D
MW-90B	1.94	28.00	MW-90A	1.93	18.00	0.01	10.00	0.0010	U
MW-97B	1.55	55.00	MW-97A	1.78	35.00	-0.23	20.00	-0.0115	D
MW-98B	3.24	52.00	MW-98A	3.30	33.00	-0.06	19.00	-0.0032	D
MW-99B	2.66	39.60	MW-99A	2.73	25.00	-0.07	14.60	-0.0048	D
Average Vertical Gradient of Deep Overburden Wells Compared to Shallow Overburden Wells								*-0.0805*	
Average Vertical Gradient of Upward Trending Deep Overburden Wells Compared to Shallow Overburden Wells								*0.0010*	
Average Vertical Gradient of Downward Trending Deep Overburden Wells Compared to Shallow Overburden Wells								*-0.0953*	

NOTES:

NA - Data not available
U - Upward Hydraulic Gradient
D - Downward Hydraulic Gradient
(FT. MSL) - Feet Mean Sea Level
MSL - Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Positive Hydraulic Gradients denote an Upward Trending and Negative Hydraulic Gradients denote a Downward Trend.
Hydraulic Gradients calculated as the ratio of change in water level elevation to the change in bottom of screen elevation.

TABLE 4-3
SUMMARY OF VERTICAL HYDRAULIC GRADIENTS FOR
DEEP VERSUS SHALLOW OVERBURDEN MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

ROUND 3									
DEEP OVERBURDEN MONITORING WELLS			SHALLOW OVERBURDENMONITORING WELLS			Change in Groundwater Level (FT.)	Change in Bottom of Well Screen (FT.)	Vertical Hydraulic Gradient 16-Mar-94 (FT/FT)	Trending of Hydraulic Gradient
Monitoring Well ID	Groundwater Elevation 16-Mar-95 (FT. MSL)	Bottom of Well Screen Elevation (FT. MSL)	Monitoring Well ID	Groundwater Elevation 16-Mar-95 (FT. MSL)	Bottom of Well Screen Elevation (FT. MSL)				
MW-28B	2.14	59.00	MW-28	4.14	7.00	-2.00	52.00	-0.0385	D
MW-48B	3.76	28.00	MW-48A	3.74	17.00	0.02	11.00	0.0018	U
MW-50B	3.39	50.30	MW-50	7.73	12.00	-4.34	38.30	-0.1133	D
MW-52B	1.85	26.50	MW-52A	2.26	12.00	-0.41	14.50	-0.0283	D
MW-55B	40.87	21.00	MW-55A	45.56	9.00	-4.69	12.00	-0.3908	D
MW-60B	2.27	45.20	MW-60	4.65	17.00	-2.38	28.20	-0.0844	D
MW-63	1.80	55.50	MW-63A	4.64	16.00	-2.84	39.50	-0.0719	D
MW-76B	5.07	26.00	MW-76A	6.35	13.50	-1.28	12.50	-0.1024	D
MW-79B	2.60	28.00	OB-05A	7.96	9.50	-5.36	18.50	-0.2897	D
MW-90B	1.85	28.00	MW-90A	1.90	18.00	-0.05	10.00	-0.0050	D
MW-97B	1.25	55.00	MW-97A	1.39	35.00	-0.14	20.00	-0.0070	D
MW-98B	2.28	52.00	MW-98A	2.49	33.00	-0.21	19.00	-0.0111	D
MW-99B	1.62	39.60	MW-99A	1.61	25.00	0.01	14.60	0.0007	U
Average Vertical Gradient of Deep Overburden Wells Compared to Shallow Overburden Wells								*-0.0877*	
Average Vertical Gradient of Upward Trending Deep Overburden Wells Compared to Shallow Overburden Wells								*0.0013*	
Average Vertical Gradient of Downward Trending Deep Overburden Wells Compared to Shallow Overburden Wells								*-0.1039*	
Average Overburden Vertical Gradient Values for 3 Novemer 1994								*-0.0708*	
Average Overburden Vertical Gradient Values for 19 January 1995								*-0.0805*	
Average Overburden Vertical Gradient Values for 16 March 1995								*-0.0877*	
Average Overburden Vertical Gradients								*-0.0797*	

NOTES:

NA - Data not available
U - Upward Hydraulic Gradient
D - Downward Hydraulic Gradient

(FT. MSL) - Feet Mean Sea Level
MSL - Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Positive Hydraulic Gradients denote an Upward Trending and Negative Hydraulic Gradients denote a Downward Trend.
Hydraulic Gradients calculated as the ratio of change in water level elevation to the change in bottom of screen elevation.

TABLE 4-4
SUMMARY OF HORIZONTAL HYDRAULIC GRADIENTS FOR BEDROCK MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

NORTHERN MONITORING WELLS		SOUTHERN MONITORING WELLS					
Monitoring Well ID	Groundwater Elevation 3-Nov-94 (FT. MSL)	Monitoring Well ID	Groundwater Elevation 3-Nov-94 (FT. MSL)	Change In Groundwater Level (FT.)	Change In Distance Between Wells (FT.)	Horizontal Hydraulic Gradient 3-Nov-94 (FT/FT)	Hydrologic Zone
MW-49C	6.81	MW-90C	----	----	2543.75	----	South
MW-50C	2.02	MW-96C	-1.32	3.34	2178.58	0.0015	South
MW-71C	34.13	MW-6C	2.67	31.46	3230.07	0.0097	North/South
MW-74C	50.01	MW-49C	6.81	43.20	3941.36	0.0110	North/South
MW-86C	10.41	MW-50C	2.02	8.39	3690.62	0.0023	North/South
MW-87C	46.78	MW-6C	2.67	44.11	3768.76	0.0117	North/South
MW-89C	18.12	MW-6C	2.67	15.45	2528.79	0.0061	North/South
MW-89C	18.12	MW-79C	2.17	15.95	3221.78	0.0050	North/South
MW-90C	----	MW-60C	0.76	----	3592.51	----	South
MW-103C	62.88	MW-50C	2.02	60.86	7848.36	0.0078	North/South
MW-103C	62.88	MW-75C	3.09	59.79	4657.84	0.0128	North/South
MW-103C	62.88	MW-86C	10.41	52.47	4875.03	0.0108	North
MW-105C	59.21	MW-87C	46.78	12.43	2126.81	0.0058	North
Average Bedrock Horizontal Hydraulic Gradient - Northern Zone						***0.0083***	
Average Bedrock Horizontal Hydraulic Gradient - Southern Zone						***0.0015***	
Average Bedrock Horizontal Hydraulic Gradient - Northern & Southern						***0.0083***	

NOTES:

(FT. MSL) - Feet Mean Sea Level
MSL - Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Hydraulic Gradients calculated as the ratio of change in water level elevation to the change in distance between the two wells.
---- - Data not usable do to suspected error in measurement.

TABLE 4-4
SUMMARY OF HORIZONTAL HYDRAULIC GRADIENTS FOR
BEDROCK MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

NORTHERN MONITORING WELLS		SOUTHERN MONITORING WELLS		Change in Groundwater Level (FT.)	Change in Distance Between Wells (FT.)	Horizontal Hydraulic Gradient 19-Jan-95 (FT/FT)	Hydrologic Zone
Monitoring Well ID	Groundwater Elevation 19-Jan-95 (FT. MSL)	Monitoring Well ID	Groundwater Elevation 19-Jan-95 (FT. MSL)				
MW-49C	7.62	MW-90C	1.15	6.47	2543.75	0.0025	South
MW-50C	2.78	MW-96C	-0.04	2.82	2178.58	0.0013	South
MW-71C	34.40	MW-6C	2.79	31.61	3230.07	0.0098	North/South
MW-74C	49.11	MW-49C	7.62	41.49	3941.36	0.0105	North/South
MW-86C	10.93	MW-50C	2.78	8.15	3690.62	0.0022	North/South
MW-87C	46.61	MW-6C	2.79	43.82	3768.76	0.0116	North/South
MW-89C	18.46	MW-6C	2.79	15.67	2528.79	0.0062	North/South
MW-89C	18.46	MW-79C	2.52	15.94	3221.78	0.0049	North/South
MW-90C	1.15	MW-60C	1.70	-0.55	3592.51	-0.0002	South
MW-103C	62.91	MW-50C	2.78	60.13	7848.36	0.0077	North/South
MW-103C	62.91	MW-75C	2.75	60.16	4657.84	0.0129	North/South
MW-103C	62.91	MW-86C	10.93	51.98	4875.03	0.0107	North
MW-105C	59.28	MW-87C	46.61	12.67	2126.81	0.0060	North
Average Bedrock Horizontal Hydraulic Gradient - Northern Zone						*0.0083*	
Average Bedrock Horizontal Hydraulic Gradient - Southern Zone						*0.0012*	
Average Bedrock Horizontal Hydraulic Gradient - Northern & Southern						*0.0082*	

NOTES:

(FT. MSL) - Feet Mean Sea Level
MSL - Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Hydraulic Gradients calculated as the ratio of change in water level elevation to the change in distance between the two wells.

TABLE 4-4
SUMMARY OF HORIZONTAL HYDRAULIC GRADIENTS FOR
BEDROCK MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

NORTHERN MONITORING WELLS		SOUTHERN MONITORING WELLS		Change in Groundwater Level (FT.)	Change in Distance Between Wells (FT.)	Horizontal Hydraulic Gradient 16-Mar-94 (FT/FT)	Hydrologic Zone
Monitoring Well ID	Groundwater Elevation 16-Mar-95 (FT. MSL)	Monitoring Well ID	Groundwater Elevation 16-Mar-95 (FT. MSL)				
MW-49C	7.78	MW-90C	1.52	6.26	2543.75	0.0025	South
MW-50C	2.75	MW-96C	0.32	2.43	2178.58	0.0011	South
MW-71C	34.47	MW-6C	2.85	31.62	3230.07	0.0098	North/South
MW-74C	49.97	MW-49C	7.78	42.19	3941.36	0.0107	North/South
MW-86C	8.97	MW-50C	2.75	6.22	3690.62	0.0017	South
MW-87C	46.55	MW-6C	2.85	43.70	3768.76	0.0116	North/South
MW-89C	18.53	MW-6C	2.85	15.68	2528.79	0.0062	North/South
MW-89C	18.53	MW-79C	2.66	15.87	3221.78	0.0049	North/South
MW-90C	1.52	MW-60C	1.73	-0.21	3592.51	-0.0001	South
MW-103C	62.98	MW-50C	2.75	60.23	7848.36	0.0077	North/South
MW-103C	62.98	MW-75C	5.16	57.82	4657.84	0.0124	North/South
MW-103C	62.98	MW-86C	8.97	54.01	4875.03	0.0111	North/South
MW-105C	59.35	MW-87C	46.55	12.80	2126.81	0.0060	North
Average Bedrock Horizontal Hydraulic Gradient - Northern Zone						***0.0060***	
Average Bedrock Horizontal Hydraulic Gradient - Southern Zone						***0.0013***	
Average Bedrock Horizontal Hydraulic Gradient - Northern & Southern						***0.0093***	

NOTES:

(FT. MSL) - Feet Mean Sea Level
MSL - Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Hydraulic Gradients calculated as the ratio of change in water level elevation to the change in distance between the two wells.

TABLE 4-5
SUMMARY OF VERTICAL HYDRAULIC GRADIENTS FOR
BEDROCK VERSUS OVERBURDEN MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

ROUND 1									
BEDROCK MONITORING WELLS			OVERBURDEN MONITORING WELLS			Change in Groundwater Level (FT.)	Change in Bottom of Well Screen (FT.)	Vertical Hydraulic Gradient 3-Nov-94 (FT/FT)	Trend of Hydraulic Gradient
Monitoring Well ID	Groundwater Elevation 3-Nov-94 (FT. MSL)	Bottom of Well Elevation (FT. MSL)	Monitoring Well ID	Groundwater Elevation 3-Nov-94 (FT. MSL)	Bottom of Well Screen Elevation (FT. MSL)				
MW-47C	7.72	43.00	MW-47A	7.90	12.00	-0.18	31.00	-0.0058	D
MW-49C	6.81	49.00	MW-49	6.91	17.00	-0.10	32.00	-0.0031	D
MW-50C	2.02	103.30	MW-50B	1.76	50.30	0.26	53.00	0.0049	U
MW-59C	9.79	78.00	MW-59	6.85	17.00	2.94	61.00	0.0482	U
MW-60C	0.76	82.00	MW-60B	0.26	45.20	0.50	36.80	0.0136	U
MW-6C	2.67	72.25	MW-6	2.61	17.50	0.06	54.75	0.0011	U
MW-74C	50.01	116.00	MW-74B	47.24	68.00	2.77	48.00	0.0577	U
MW-75C	3.09	65.00	MW-75A	4.49	17.50	-1.40	47.50	-0.0295	D
MW-76C	4.63	58.00	MW-76B	4.62	26.00	0.01	32.00	0.0003	U
MW-86C	10.41	93.33	MW-86A	8.96	18.00	1.45	75.33	0.0192	U
MW-87C	46.78	84.00	MW-87A	51.25	30.00	-4.47	54.00	-0.0828	D
MW-88C	39.12	99.00	MW-88A	46.09	21.00	-6.97	78.00	-0.0894	D
MW-89C	18.12	69.60	MW-89A	18.88	12.00	-0.76	57.60	-0.0132	D
MW-90C	----	88.00	MW-90B	-0.31	28.00	----	60.00	----	----
MW-103C	62.88	94.00	MW-103A	60.80	30.00	2.08	64.00	0.0325	U
MW-104C	59.65	92.00	MW-104A	60.67	40.00	-1.02	52.00	-0.0196	D
MW-105C	59.21	125.50	MW-105A	59.92	46.00	-0.71	79.50	-0.0089	D
Average Vertical Gradient of Bedrock Wells Compared to Overburden Wells								*-0.0047*	
Average Vertical Gradient of Upward Trending Bedrock Wells Compared to Overburden Wells								*0.0222*	
Average Vertical Gradient of Downward Trending Bedrock Wells Compared to Overburden Wells								*-0.0315*	

NOTES:

N/A - Not Applicable
U - Upward Hydraulic Gradient
(FT. MSL) - Feet Mean Sea Level
D - Downward Hydraulic Gradient
---- - Data not usable do to suspected error in measurement.
MSL - Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Hydraulic Gradients calculated as the ratio of change in water level elevation to the change in bottom of screen elevation.
Positive Hydraulic Gradients denote an Upward Trend and Negative Hydraulic Gradients denote a Downward Trend.
9.79 - Due to possible measurement error, this reading is suspect when compared with the other two rounds of GW level monitoring.

TABLE 4-5
SUMMARY OF VERTICAL HYDRAULIC GRADIENTS FOR
BEDROCK VERSUS OVERBURDEN MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

ROUND 2						Change in Groundwater Level (FT.)	Change in Bottom of Well Screen (FT.)	Vertical Hydraulic Gradient 19-Jan-95 (FT/FT)	Trend of Hydraulic Gradient
BEDROCK MONITORING WELLS			OVERBURDEN MONITORING WELLS						
Monitoring Well ID	Groundwater Elevation 19-Jan-95 (FT. MSL)	Bottom of Well Elevation (FT. MSL)	Monitoring Well ID	Groundwater Elevation 19-Jan-95 (FT. MSL)	Bottom of Well Screen Elevation (FT. MSL)				
MW-47C	8.59	43.00	MW-47A	8.24	12.00	0.35	31.00	0.0113	U
MW-49C	7.62	49.00	MW-49	7.80	17.00	-0.18	32.00	-0.0056	D
MW-50C	2.78	103.30	MW-50B	3.79	50.30	-1.01	53.00	-0.0191	D
MW-59C	5.39	78.00	MW-59	7.30	17.00	-1.91	61.00	-0.0313	D
MW-60C	1.70	82.00	MW-60B	2.52	45.20	-0.82	36.80	-0.0223	D
MW-6C	2.79	72.25	MW-6	3.71	17.50	-0.92	54.75	-0.0168	D
MW-74C	49.11	116.00	MW-74B	46.92	68.00	2.19	48.00	0.0456	U
MW-75C	2.75	65.00	MW-75A	2.23	17.50	0.52	47.50	0.0109	U
MW-76C	5.30	58.00	MW-76B	5.57	26.00	-0.27	32.00	-0.0084	D
MW-86C	10.93	93.33	MW-86A	9.18	18.00	1.75	75.33	0.0232	U
MW-87C	46.61	84.00	MW-87A	50.94	30.00	-4.33	54.00	-0.0802	D
MW-88C	39.04	99.00	MW-88A	46.10	21.00	-7.06	78.00	-0.0905	D
MW-89C	18.46	69.60	MW-89A	21.22	12.00	-2.76	57.60	-0.0479	D
MW-90C	1.15	88.00	MW-90B	1.94	28.00	-0.79	60.00	-0.0132	D
MW-103C	62.91	94.00	MW-103A	61.01	30.00	1.90	64.00	0.0297	U
MW-104C	59.41	92.00	MW-104A	59.73	40.00	-0.32	52.00	-0.0062	D
MW-105C	59.28	125.50	MW-105A	59.40	46.00	-0.12	79.50	-0.0015	D
Average Vertical Gradient of Bedrock Wells Compared to Overburden Wells								*-0.0131*	
Average Vertical Gradient of Upward Trending Bedrock Wells Compared to Overburden Wells								*0.0242*	
Average Vertical Gradient of Downward Trending Bedrock Wells Compared to Overburden Wells								*-0.0286*	

NOTES:

N/A - Not Applicable
U - Upward Hydraulic Gradient
(FT. MSL) - Feet Mean Sea Level
D - Downward Hydraulic Gradient
---- - Data not usable do to suspected error in measurement.
MSL - Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Hydraulic Gradients calculated as the ratio of change in water level elevation to the change in bottom of screen elevation.
Positive Hydraulic Gradients denote an Upward Trend and Negative Hydraulic Gradients denote a Downward Trend.
9.79 - Due to possible measurement error, this reading is suspect when compared with the other two rounds of GW level monitoring.

TABLE 4-5
SUMMARY OF VERTICAL HYDRAULIC GRADIENTS FOR BEDROCK VERSUS OVERBURDEN MONITORING WELLS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

ROUND 3									
BEDROCK MONITORING WELLS			OVERBURDEN MONITORING WELLS						
Monitoring Well ID	Groundwater Elevation 16-Mar-95 (FT. MSL)	Bottom of Well Elevation (FT. MSL)	Monitoring Well ID	Groundwater Elevation 16-Mar-95 (FT. MSL)	Bottom of Well Screen Elevation (FT. MSL)	Change in Groundwater Level (FT.)	Change in Bottom of Well Screen (FT.)	Vertical Hydraulic Gradient 16-Mar-94 (FT/FT)	Trend of Hydraulic Gradient
MW-47C	8.91	43.00	MW-47A	8.29	12.00	0.62	31.00	0.0200	U
MW-49C	7.78	49.00	MW-49	7.95	17.00	-0.17	32.00	-0.0053	D
MW-50C	2.75	103.30	MW-50B	3.39	50.30	-0.64	53.00	-0.0121	D
MW-59C	5.38	78.00	MW-59	7.39	17.00	-2.01	61.00	-0.0330	D
MW-60C	1.73	82.00	MW-60B	2.27	45.20	-0.54	36.80	-0.0147	D
MW-6C	2.85	72.25	MW-6	3.78	17.50	-0.93	54.75	-0.0170	D
MW-74C	47.97	116.00	MW-74B	49.06	68.00	-1.09	48.00	-0.0227	D
MW-75C	5.16	65.00	MW-75A	5.25	17.50	-0.09	47.50	-0.0019	D
MW-76C	5.50	58.00	MW-76B	5.07	26.00	0.43	32.00	0.0134	U
MW-86C	8.97	93.33	MW-86A	9.18	18.00	-0.21	75.33	-0.0028	D
MW-87C	46.55	84.00	MW-87A	51.05	30.00	-4.50	54.00	-0.0833	D
MW-88C	39.15	99.00	MW-88A	46.13	21.00	-6.98	78.00	-0.0895	D
MW-89C	18.53	69.60	MW-89A	21.56	12.00	-3.03	57.60	-0.0526	D
MW-90C	1.52	88.00	MW-90B	1.85	28.00	-0.33	60.00	-0.0055	D
MW-103C	62.98	94.00	MW-103A	61.37	30.00	1.61	64.00	0.0252	U
MW-104C	59.30	92.00	MW-104A	59.87	40.00	-0.57	52.00	-0.0110	D
MW-105C	59.35	125.50	MW-105A	59.45	46.00	-0.10	79.50	-0.0013	D
Average Vertical Gradient of Bedrock Wells Compared to Overburden Wells								*-0.0173*	
Average Vertical Gradient of Upward Trending Bedrock Wells Compared to Overburden Wells								*0.0195*	
Average Vertical Gradient of Downward Trending Bedrock Wells Compared to Overburden Wells								*-0.0252*	
Average Bedrock to Overburden Vertical Gradient Values for 3 Novemer 1994								*-0.0047*	
Average Bedrock to Overburden Vertical Gradient Values for 19 January 1995								*-0.0131*	
Average Bedrock to Overburden Vertical Gradient Values for 16 March 1995								*-0.0173*	
Average Bedrock to Overburden Vertical Gradients								*-0.0117*	

NOTES:

N/A - Not Applicable
U - Upward Hydraulic Gradient
(FT. MSL) - Feet Mean Sea Level
D - Downward Hydraulic Gradient
---- - Data not usable do to suspected error in measurement.
MSL - Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.
Hydraulic Gradients calculated as the ratio of change in water level elevation to the change in bottom of screen elevation.
Positive Hydraulic Gradients denote an Upward Trend and Negative Hydraulic Gradients denote a Downward Trend.
9.79 - Due to possible measurement error, this reading is suspect when compared with the other two rounds of GW level monitoring.

TABLE 4-6
SUMMARY OF SURFACE WATER VERSUS GROUNDWATER ELEVATIONS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

STAFF GAUGE I.D.	DRAINAGE AREA	SURFACE WATER ELEVATION (FT MSL)			MONITORING WELL I.D.	HYDROLOGIC UNIT SCREENED	GROUNDWATER ELEVATION (FT MSL)			HEAD DIFFERENCE SURFACE WATER vs GROUNDWATER ELEVATIONS			COMMENTS		
		Round 1 (LT)	Round 2 (HT)	Round 3 (HT)			Round 1	Round 2	Round 3	Round 1	Round 2	Round 3	Round 1	Round 2	Round 3
SG-10	2	-0.41	3.63	0.23	MW-98A	LS	1.70	3.30	2.49	-2.11	0.33	-2.26	G	L	G
SG-10	2	-0.41	3.63	0.23	MW-98B	LS	1.68	3.24	2.28	-2.09	0.39	-2.05	G	L	G
SG-10	2	-0.41	3.63	0.23	MW-99A	LS	1.59	2.73	1.61	-2.00	0.90	-1.38	G	L	G
SG-10	2	-0.41	3.63	0.23	MW-99B	LS	1.60	2.66	1.62	-2.01	0.97	-1.39	G	L	G
SG-11	2	2.04	3.74	2.05	MW-66	LS	1.69	4.19	1.96	0.35	-0.45	0.09	L	G	L
SG-11	2	2.04	3.74	2.05	MW-21	LS	2.62	4.47	3.45	-0.58	-0.73	-1.40	G	G	G
SG-15	2	3.49	4.06	3.23	MW-19	LS	3.21	4.15	3.74	0.28	-0.09	-0.51	L	G	G
SG-15	2	3.49	4.06	3.23	MW-42A	LS	6.87	7.49	5.53	-3.38	-3.43	-2.30	G	G	G
SG-12	3	29.04	28.83	28.84	MW-EPA-2A	NA	41.76	42.47	42.95	-12.72	-13.64	-14.11	G	G	G
SG-14	3	21.01	20.69	20.66	MW-8	LS	28.30	28.44	28.39	-7.29	-7.75	-7.73	G	G	G
SG-14	3	21.01	20.69	20.66	MW-7	LS	26.09	26.39	26.41	-5.08	-5.70	-5.75	G	G	G
SG-2	3	-1.10	2.80	NA	MW-100A	US	4.11	5.74	5.91	-5.21	-2.94	NA	G	G	NA
SG-2	3	-1.10	2.80	NA	MW-62	LS	-2.95	-2.21	-2.91	1.85	5.01	NA	L	L	NA
SG-6	3	0.46	2.31	0.07	MW-62	LS	-2.95	-2.21	-2.19	3.41	4.52	2.26	L	L	L
SG-16	4	3.46	3.47	3.45	MW-79B	LS	2.10	2.58	2.60	1.36	0.89	0.85	L	L	L
SG-7	4	3.11	3.56	3.35	MW-93A	LS	0.19	0.89	1.08	2.92	2.67	2.27	L	L	L
SG-7	4	3.11	3.56	3.35	MW-93B	LS	0.05	0.87	0.93	3.06	2.69	2.42	L	L	L
SG-8	4	3.14	3.71	3.55	MW-28B	LS	-1.96	2.33	2.14	5.10	1.38	1.41	L	L	L
SG-8	4	3.14	3.71	3.55	MW-28B	LS	-1.96	2.33	2.14	5.10	1.38	1.41	L	L	L
SG-1	5	1.09	NA	3.36	MW-60B	LS	0.26	2.52	2.27	0.83	NA	1.09	L	NA	L
SG-13	6	1.88	2.19	2.12	MW-90A	LS	-0.29	1.93	1.90	2.17	0.26	0.22	L	L	L
SG-13	6	1.88	2.19	2.12	MW-90B	LS	-0.31	1.94	1.85	2.19	0.25	0.27	L	L	L
SG-5	6	1.89	2.10	2.26	MW-54	MM/LS	0.94	1.24	1.33	0.95	0.86	0.93	L	L	L
SG-4	6	-3.56	-2.43	-1.14	MW-91A	LS	1.44	2.04	1.91	-5.00	-4.47	-3.05	G	G	G
SG-4	6	-3.56	-2.43	-1.14	MW-91B	LS	1.36	2.39	2.31	-4.92	-4.82	-3.45	G	G	G

Notes:
- US - Upper Sand
- LS - Lower Sand
- MM - Meadowmat
- L - Losing Stream
- NA - Not Available
- G - Gaining Stream
- FT MSL - Feet Mean Sea Level

Round 1 - Measured on 3 November 1994
Round 2 - Measured on 19 January 1995
Round 3 - Measured on 16 March 1995
(LT): Water level measurements collected during low tide.
(HT): Water level measurements collected during high tide.
WBK - Weathered Bedrock Group (Raritan Fire Clay and Weathered Bedrock)
Elevation data are reported in National Geodetic Vertical Datum (NGVD) of 1929.

TABLE 4-7
SUMMARY OF TIDAL INFLUENCE INVESTIGATION:
TIDALLY INFLUENCED MONITORING WELLS AND STAFF GAUGES
ROUND 1 AND ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

LOCATION	ROUND 1 MONITORING EVENT - JANUARY 19, 1995					ROUND 2 MONITORING EVENT MARCH 16, 1995					DISTANCE FROM NEAREST SURFACE WATER BODY (2)
	Maximum Elevation (Ft. MSL)	Minimum Elevation (Ft. MSL)	Average Water Level (Ft. MSL)	Total Deflection (Ft.)	Tidal Efficiency	Maximum Elevation (Ft. MSL)	Minimum Elevation (Ft. MSL)	Average Water Level (Ft. MSL)	Total Deflection (Ft.)	Tidal Efficiency (1)	
MW-90A	2.090	1.908	2.000	0.18	86.53%	2.006	1.824	1.909	0.18	52.17%	50 ft. from SG-13
MW-91A	NA	NA	NA	NA	NA	3.113	1.441	2.452	1.67	23.39%	100 ft. from SG-4
MW-93A	1.132	0.815	0.947	0.32	4.53%	1.093	0.948	1.034	0.15	2.07%	2250 ft. from SG-2
MW-94A	NA	NA	NA	NA	NA	1.810	1.709	1.757	0.10	5.07%	250 ft. from SG-9
MW-96A	1.317	-0.990	-0.024	2.31	26.67%	NA	NA	NA	NA	NA	437.5 ft. from SG-2
MW-99A	3.085	1.871	2.495	1.21	21.69%	1.742	1.486	1.594	0.26	4.78%	750 ft. from SG-10
MW-50C	2.980	2.700	2.857	0.28	3.74%	2.828	2.719	2.775	0.11	1.70%	1100 ft. from SG-2
MW-60C	1.808	1.583	1.707	0.23	3.31%	1.815	1.590	1.687	0.23	3.58%	250 ft. from SG-2
MW-76C	5.420	5.268	5.315	0.15	1.75%	5.508	5.486	5.498	0.02	0.28%	4875 ft. from SG-2
MW-79C	2.609	2.495	2.531	0.11	1.25%	2.679	2.651	2.664	0.03	0.45%	4825 ft. from SG-2
MW-96C	0.316	-0.486	-0.168	0.80	7.70%	-0.435	-0.870	-0.677	0.44	6.73%	437.5 ft. from SG-2
SG-2	4.433	-1.677	0.978	6.11	100.00%	NA	NA	NA	NA	100.00%	Raritan River
SG-4	-2.426	-4.897	-3.096	2.47	34.17%	-1.093	-4.300	-2.231	3.21	69.27%	West Ditch
SG-5	2.191	1.973	2.078	0.22	3.04%	2.414	2.017	2.221	0.40	5.57%	Old Red Root Creek
SG-6	NA	NA	NA	NA	NA	0.281	-1.852	-0.839	2.13	40.60%	Red Root Creek
SG-8	4.285	3.400	3.540	0.89	5.33%	3.809	3.289	3.448	0.52	7.65%	Central Ditch
SG-9	3.219	1.000	2.212	2.22	34.90%	1.031	-0.778	-0.028	1.81	36.66%	Red Root Creek
SG-10	3.915	-0.561	1.502	4.48	85.94%	0.244	0.204	0.227	0.04	0.49%	Black Ditch
SG-11	3.987	1.222	2.279	2.77	50.68%	2.085	2.008	2.050	0.08	1.15%	Black Ditch
SG-13	2.267	2.040	2.154	0.23	3.14%	2.255	1.873	2.070	0.38	5.44%	Old Red Root Creek
SG-15	4.442	3.243	3.452	1.20	16.16%	3.365	3.221	3.246	0.14	1.35%	Black Ditch
SG-16	3.510	3.459	3.468	0.05	0.29%	3.502	3.448	3.470	0.05	0.85%	Area 8 Pond
SG-17	2.963	2.872	2.883	0.09	0.82%	2.917	2.868	2.894	0.05	0.84%	Old Red Root Creek

Notes:

(1) Tidal efficiencies are calculated with respect to an estimated SG-2 standard deviation.

(2) The shortest distance from the Monitoring Well to the coresponding surface water body is reported. The Staff Gauge listed is located on the surface water body.

Ft. MSL - Feet Mean Sea Level

Elevation data are presented in National Geodetic Vertical Datum (NGVD) of 1929.

NA - Not Available due to malfunction of Well Sentinel during Tidal Influence Investigation.

TABLE 4-8
SUMMARY OF TIDAL INFLUENCE INVESTIGATION:
MONITORING WELLS INFLUENCED BY BAROMETRIC PRESSURE
ROUND 1 AND ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

LOCATION	ROUND 1 MONITORING EVENT JANUARY 19, 1995			ROUND 2 MONITORING EVENT MARCH 16, 1995		
	Average Water Level [Ft. MSL]	Total Deflection [Ft.]	Barometric Efficiency	Average Water Level [Ft. MSL]	Total Deflection [Ft.]	Barometric Efficiency
MW-50A	8.734	0.17	15.87%	7.756	0.16	35.58%
MW-60	4.873	0.29	25.60%	4.680	0.15	26.77%
MW-61	4.190	0.39	34.80%	4.109	0.14	28.06%
MW-76B	5.655	0.52	47.57%	5.114	0.19	40.65%
MW-77A	NA	NA	NA	6.129	0.19	45.60%
MW-79B	2.618	0.21	18.52%	2.621	0.08	17.33%
OB-05A	NA	NA	NA	8.022	0.33	188.33%
MW-80A	3.246	0.13	11.09%	3.389	0.08	14.31%

Notes:

Ft. MSL - Feet Mean Sea Level
Elevation data are presented in National Geodetic Vertical Datum (NGVD) of 1929.
NA - Not Available due to malfunction of Well Sentinel during Tidal Influence Investigation.

TABLE 5-1
1988/1989 O'BRIEN & GERE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-4	MW-5	MW-6	MW-7	MW-8	MW-8QA	MW-9	MW-10	NJDEP GWQS
VOCs (ug/L)									
1,1-Dichloroethane	220.0	ND	ND	ND	ND	ND	ND	ND	70
1,1-Dichloroethylene	26.0	ND	ND	ND	ND	ND	ND	ND	2
Benzene	16.0	ND	ND	ND	ND	ND	ND	ND	1
Methylene Chloride	ND	ND	ND	ND	ND	2.0	ND	ND	2
trans-1,2-Dichloroethylene	ND	ND	ND	ND	8.0	8.0	4.0	ND	100
Trichloroethylene	380.0	ND	ND	5.0	170.0	170.0	3.0	ND	1
TOTAL VOCs	642.0	ND	ND	5.0	178.0	180.0	7.0	ND	
TPHCs (mg/L)	5	<1	<1	<1	<1	<1	<1	<1	NN
METALS (mg/L)									
Arsenic	<0.01	<0.01	0.04	<0.01	<0.01	NA	<0.01	<0.01	0.008
Barium	<0.2	<0.2	<0.2	<0.2	<0.2	NA	<0.2	<0.2	2
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005	0.004
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	0.011	0.1
Lead	0.009	0.014	<0.005	<0.005	<0.005	NA	0.006	<0.005	0.01
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	NA	<0.0002	<0.0002	0.002
Selenium	<0.05*	<0.005	<0.005	<0.005	<0.005	NA	<0.005	<0.005	0.05
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	<0.01	NCA
EXPLOSIVES (mg/L)									
1,3,5-TNB	<0.56	<0.56	<5.60	<0.56	<0.56	NA	<0.56	<0.56	NCA
1,3-DNB	<0.61	<0.61	<6.10G	<0.61	<0.61	NA	<0.61	<0.61	NCA
2,4,6-TNT	<0.78	<0.78	<0.78	<0.78	<0.78	NA	<0.78	<0.78	NCA
2,4-DNT	<0.60	<0.60	<0.60	<0.60	<0.60	NA	<0.60	<0.60	0.01
2,6-DNT	<0.55	<0.55	<0.55	<0.55	<0.55	NA	<0.55	<0.55	0.01
HMX	<1.30	<1.30	<13.0G	<1.30	<1.30	NA	<1.30	<1.30	NCA
Nitrobenzene	<1.13	<1.13	<11.3G	<1.13	<1.13	NA	<1.13	<1.13	NCA
RDX	<0.63	<0.63	<6.30 G	<1.23 G	<0.63	NA	<0.63	<0.63	NCA
Tetryl	<0.66	<0.66	<0.66	<0.66	<0.66	NA	<0.66	<0.66	NCA

Notes: See Page 4 of 4.

TABLE 5-1
1988/1989 O'BRIEN & GERE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-11	MW-12	MW-13	MW-14	MW-15	MW-15QA	MW-16	MW-17	NJDEP GWQS
VOCs (ug/L)									
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	70
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	2
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	1
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	2
trans-1,2-Dichloroethylene	ND	ND	18.0	ND	ND	ND	ND	ND	100
Trichloroethylene	ND	ND	43.0	6.0	ND	ND	ND	ND	1
TOTAL VOCs	ND	ND	61.0	6.0	ND	ND	ND	ND	
TPHCs (mg/L)	<1	<1	6	<1	<1	<1	<1	<1	NN
METALS (mg/L)									
Arsenic	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	<0.01	0.008
Barium	<0.2	<0.2	<0.2	<0.2	<0.2	NA	<0.2	<0.2	2
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	NA	0.011	<0.005	0.004
Chromium	<0.01	0.048	<0.01	0.014	<0.01	NA	0.031	<0.01	0.1
Lead	<0.05*	<0.05*	0.005	<0.05*	<0.005	NA	<0.05*	0.016	0.01
Mercury	<0.0002	<0.0002	0.0004	<0.0002	<0.0002	NA	<0.0002	<0.0002	0.002
Selenium	<0.005	<0.005	<0.005	<0.005	<0.05*	NA	<0.005	<0.005	0.05
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	NA	<0.01	<0.01	NCA
EXPLOSIVES (mg/L)									
1,3,5-TNB	<0.56	<0.56	<1.12G	<56.0	<56.0	NA	<0.56	3.93	NCA
1,3-DNB	<0.61	<0.61	<0.61	<0.61	<61.0	NA	<0.61	<0.61	NCA
2,4,6-TNT	<0.78	<0.78	<0.78	<0.78	<78.0	NA	<0.78	<0.78	NCA
2,4-DNT	<0.60	<0.60	<0.60	<0.60	<60.0	NA	<0.60	<0.60	0.01
2,6-DNT	<0.55	<0.55	<0.55	<0.55	<55.0	NA	<0.55	<0.55	0.01
HMX	<13.0 G	<1.30	<39.6 G	<1.30	<13000 G	NA	<13.0 G	<1.30	NCA
Nitrobenzene	<1.13	<1.13	<1.13	<1.13	<113	NA	<1.13	<1.13	NCA
RDX	<6.30 G	<0.63	<6.30 G	<0.63	<63.0	NA	<0.63	<2.09	NCA
Tetryl	<0.66	<0.66	<0.66	<0.66	<66.0	NA	1.54	<0.66	NCA

Notes: See Page 4 of 4.

TABLE 5-1
1988/1989 O'BRIEN & GERE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-18	MW-19	MW-20	MW-21	MW-22	MW-25	MW-26	MW-27	NJDEP GWQS
VOCs (ug/L)									
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	70
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	2
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	1
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	2
trans-1,2-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	100
Trichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	1
TOTAL VOCs	ND	ND	ND	ND	ND	ND	ND	ND	
TPHCs (mg/L)	<1	<1	<1	<1	<1	<1	<1	<1	NN
METALS (mg/L)									
Arsenic	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.008
Barium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	2
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.004
Chromium	0.023	<0.01	0.035	0.020	<0.01	0.01	0.01	<0.01	0.1
Lead	<0.005	<0.005	<0.005	<0.05*	<0.005	<0.005	<0.005	<0.005	0.01
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.002
Selenium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.05*	0.05
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NCA
EXPLOSIVES (mg/L)									
1,3,5-TNB	<0.56	<1.12 G	NA	NA	NA	<0.56	<0.56	<0.56	NCA
1,3-DNB	<0.61	<0.61	NA	NA	NA	<0.61	<0.61	<0.61	NCA
2,4,6-TNT	<0.78	<0.66	NA	NA	NA	<0.78	<0.78	<0.78	NCA
2,4-DNT	<0.60	<0.60	NA	NA	NA	<0.60	<0.60	<0.60	0.01
2,6-DNT	<0.55	<0.55	NA	NA	NA	<0.55	<0.55	<0.55	0.01
HMX	<1.30	1.43	NA	NA	NA	<1.30	<1.30	<1.30	NCA
Nitrobenzene	<1.13	<1.13	NA	NA	NA	<1.13	<1.13	<1.13	NCA
RDX	<0.63	<0.63	NA	NA	NA	<0.63	<0.63	<0.63	NCA
Tetryl	<0.66	<1.13	NA	NA	NA	<0.66	<0.66	<0.66	NCA

Notes: See Page 4 of 4.

TABLE 5-1
1988/1989 O'BRIEN & GERE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-28	MW-29	MW-30	MW-31	MW-34	MW-35	MW-36	MW-37	NJDEP GWQS
VOCs (ug/L)									
1,1-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	70
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	2
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	1
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	2
trans-1,2-Dichloroethylene	ND	ND	ND	17.0	ND	ND	ND	ND	100
Trichloroethylene	ND	ND	ND	250.0	ND	ND	ND	ND	1
TOTAL VOCs	ND	ND	ND	267.0	ND	ND	ND	ND	
TPHCs (mg/L)	<1	<1	<1	<1	<1	<1	<1	<1	NN
METALS (mg/L)									
Arsenic	<0.1*	0.02	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	0.008
Barium	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	2
Cadmium	<0.008	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.004
Chromium	0.03	0.02	0.02	0.010	0.020	0.011	0.026	0.010	0.1
Lead	<0.05*	0.011	0.011	<0.005	<0.05*	<0.005	0.007	<0.005	0.01
Mercury	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.002
Selenium	<0.05*	<0.05*	<0.05*	<0.005	<0.005	<0.005	<0.005	<0.005	0.05
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	NCA
EXPLOSIVES (mg/L)									
1,3,5-TNB	<5.6	<5.6	<5.6	<0.56	<0.56	<0.56	<0.56	<0.56	NCA
1,3-DNB	<6.1	<6.1	<6.1	<0.61	<0.61	<0.61	<0.61	<0.61	NCA
2,4,6-TNT	<7.8	<7.8	<7.8	<0.78	<0.78	<0.78	<0.78	<0.78	NCA
2,4-DNT	<6.0	<6.0	<6.0	<0.60	<0.60	<0.60	<0.60	<0.60	0.01
2,6-DNT	<5.5	<5.5	<5.5	<0.55	<0.55	<0.55	<0.55	<0.55	0.01
HMX	<13	<13	<13	<1.30	<1.30	<13.0 G	<1.30	<1.30	NCA
Nitrobenzene	<11.3	<11.3	<11.3	<1.13	<1.13	<1.13	<1.13	<1.13	NCA
RDX	<6.3	<6.3	<6.3	<0.63	<0.63	<0.63	<0.63	<0.63	NCA
Tetryl	<6.6	<6.6	<6.6	<0.66	<0.66	<0.66	<0.66	<0.66	NCA

Notes:

NA: Not analyzed
ND: Not Detected
NN: None Noticeable
J: Estimated value below MDL
<: Less than the number indicated
NCA: No current criteria available

VOCs: Volatile organic compounds
TPC: Total petroleum hydrocarbons
G: Indicates elevated detection limit due to sample interference.
*: The detection limit has been raised due to the presence of matrix interferences.
B: Analyte also found in method blank indicating possible/probable lab blank contamination

TABLE 5-2
1992 DAMES & MOORE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-14	NJDEP GWQS
VOCs (ug/L)										
1,1,1-TCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	30
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	3.7	ND	ND	ND	2
1,1-DCA	ND	ND	ND	ND	ND	5.0	ND	ND	ND	70
1,2-DCA	ND	ND	ND	ND	ND	12.0	ND	ND	ND	2
1,2-DCE-total	ND	ND	7.3	12.0	ND	18.0	ND	120.0	ND	10
Acetone	ND	ND	ND	ND	ND	ND	ND	ND	ND	700
Benzene	ND	ND	ND	ND	ND	4.6	ND	ND	ND	1
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chlorobenzene	ND	ND	ND	ND	ND	38.0	ND	ND	ND	50
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	6
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	700
TCE	ND	5.2	130.0	ND	ND	11.0	ND	310.0	5.4	1
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	23.0	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1000
Vinyl chloride	ND	ND	ND	ND	ND	11.0	ND	15.0	ND	5
Xylenes (Total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
TOTAL VOCs	ND	5.2	137.3	12.0	ND	103.3	ND	468.0	5.4	500
BNAs (ug/L)										
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	15.0	ND	ND	ND	600
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	600
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	4.2	ND	ND	ND	75
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
Bis(2-ethylhexyl)phthalate	ND	ND	1.0	2.3	3.3	ND	ND	6.2	2.7	30
Diethyl Phthalate	ND	1.0	ND	ND	ND	ND	ND	ND	ND	5000
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	ND	100
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	4000
TOTAL BNAs	ND	1.0	1.0	2.3	3.3	19.2	ND	6.2	2.7	NCA

Notes: See Page 12 of 12.

TABLE 5-2
1992 DAMES & MOORE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-6	MW-7	MW-8	MW-9	MW-10	MW-11	MW-12	MW-13	MW-14	NJDEP GWQS
PESTICIDES (ug/L)										
BHC, A	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02
BHC, B	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
DDT, PP	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1
METALS (ug/L)										
Arsenic	8.6	10.7	ND	12.8	42.7	3.6	ND	2.8	ND	8
Barium	124	29	89	77	47.9	84	35	60	68	2000
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	4
Chromium	ND	ND	ND	8	ND	ND	ND	9.7	ND	100
Lead	ND	9.2	3.2	11	ND	ND	2.8	3.1	2	10
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	2.2	50
Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	200
EXPLOSIVES (ug/L)										
1,3,5-trinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
1,3-Dinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
HMX	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Nitroglycerin	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
PETN	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
RDX	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Thiodiglycol	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA

Notes: See Page 12 of 12.

TABLE 5-2
1992 DAMES & MOORE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-15	MW-16	MW-17	MW-18	MW-19	MW-20	MW-21	MW-22	MW-25	NJDEP GWQS
VOCs (ug/L)										
1,1,1-TCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	30
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
1,1-DCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	70
1,2-DCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
1,2-DCE-total	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Acetone	ND	ND	ND	ND	ND	ND	ND	ND	ND	700
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	50
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	6
TCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	700
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	1000
Xylenes (Total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
										40
TOTAL VOCs	ND	ND	ND	ND	ND	ND	ND	ND	ND	500
BNAs (ug/L)										
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	600
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	600
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	75
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
Bis(2-ethylhexyl)phthalate	3.9	ND	6.0	4.0	ND	ND	ND	ND	ND	30
Diethyl Phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	5000
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	ND	100
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	4000
TOTAL BNAs	3.9	ND	6.0	4.0	ND	ND	ND	ND	ND	NCA

Notes: See Page 12 of 12.

TABLE 5-2
1992 DAMES & MOORE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-15	MW-16	MW-17	MW-18	MW-19	MW-20	MW-21	MW-22	MW-25	NJDEP GWQS
PESTICIDES (ug/L)										
BHC, A	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02
BHC, B	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
DDT, PP	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1
METALS (ug/L)										
Arsenic	13.1	7.1	6.5	ND	ND	2.9	ND	ND	18.8	8
Barium	124	27	32	37	38.7	52.5	19.5	71.3	22	2000
Cadmium	5	ND	ND	ND	ND	ND	ND	ND	ND	4
Chromium	ND	ND	23	ND	ND	23.5	ND	ND	ND	100
Lead	6	ND	3.5	3	ND	6.4	ND	2.1	ND	10
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	50
Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Cyanide	NA	ND	NA	NA	NA	NA	NA	NA	ND	200
EXPLOSIVES (ug/L)										
1,3,5-trinitrobenzene	ND	ND	ND	ND	ND	ND	0.551	ND	ND	NCA
1,3-Dinitrobenzene	0.695	ND	ND	0.735	ND	ND	ND	ND	ND	NCA
2,4-Dinitrotoluene	ND	ND	4.77	ND	ND	ND	ND	ND	ND	10
HMX	ND	ND	ND	ND	ND	ND	12.8	ND	ND	NCA
Nitroglycerin	ND	22.1	ND	ND	ND	ND	ND	ND	ND	NCA
PETN	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
RDX	ND	ND	ND	ND	ND	ND	1.64	ND	ND	NCA
Thiodiglycol	ND	ND	ND	ND	22.3	ND	ND	ND	5.68	NCA

Notes: See Page 12 of 12.

TABLE 5-2
1992 DAMES & MOORE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-26	MW-27	MW-28	MW-29	MW-30	MW-31	MW-34	MW-40	MW-42A	NJDEP GWQS
VOCs (ug/L)										
1,1,1-TCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	30
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
1,1-DCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	70
1,2-DCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
1,2-DCE-total	ND	ND	ND	ND	ND	9.6	ND	4.3	ND	10
Acetone	ND	ND	ND	ND	ND	ND	ND	ND	ND	700
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	50
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	6
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	700
TCE	ND	ND	ND	ND	ND	130.0	ND	9.0	ND	1
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	3.5	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1000
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Xylenes (Total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
TOTAL VOCs	ND	ND	ND	ND	ND	139.6	ND	16.8	ND	500
BNAs (ug/L)										
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	600
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	600
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	75
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
Bis(2-ethylhexyl)phthalate	ND	ND	ND	ND	ND	ND	ND	10.0	4.5	30
Diethyl Phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	5000
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	ND	100
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	4000
TOTAL BNAs	ND	ND	ND	ND	ND	ND	ND	10.0	4.5	NCA

Notes: See Page 12 of 12.

TABLE 5-2
1992 DAMES & MOORE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-26	MW-27	MW-28	MW-29	MW-30	MW-31	MW-34	MW-40	MW-42A	NJDEP GWQS
PESTICIDES (ug/L)										
BHC, A	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02
BHC, B	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
DDT, PP	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1
METALS (ug/L)										
Arsenic	3.3	18	57.7	46.7	63	ND	ND	ND	5.4	8
Barium	49	22	299	8.4	206	43	19	52	48	2000
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	5	4
Chromium	ND	ND	ND	ND	ND	ND	ND	ND	49	100
Lead	ND	2.2	ND	ND	ND	199	3.7	ND	11.1	10
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	50
Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Cyanide	ND	ND	NA	NA	NA	NA	ND	NA	NA	200
EXPLOSIVES (ug/L)										
1,3,5-trinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
1,3-Dinitrobenzene	ND	ND	ND	ND	0.627	ND	ND	ND	ND	NCA
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
HMX	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Nitroglycerin	ND	ND	12.7	ND	ND	ND	ND	ND	ND	NCA
PETN	ND	ND	ND	ND	25.4	ND	ND	ND	ND	NCA
RDX	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Thiodiglycol	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA

Notes: See Page 12 of 12.

TABLE 5-2
1992 DAMES & MOORE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-43	MW-44	MW-45	MW-46A	MW-47A	MW-48A	MW-48B	MW-49	MW-50	NJDEP GWQS
VOCs (ug/L)										
1,1,1-TCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	30
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
1,1-DCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	70
1,2-DCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
1,2-DCE-total	ND	ND	ND	130.0	160.0	ND	ND	ND	ND	10
Acetone	ND	ND	ND	ND	ND	ND	ND	ND	ND	700
Benzene	ND	ND	ND	3.3	9.2	ND	ND	ND	ND	1
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	50
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	6
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	700
TCE	ND	ND	ND	29.0	95.0	ND	30.0	ND	ND	1
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	3.3	ND	ND	ND	ND	ND	1000
Vinyl chloride	ND	ND	ND	18.0	ND	ND	ND	ND	ND	5
Xylenes (Total)	ND	ND	ND	4.8	ND	ND	ND	ND	ND	40
TOTAL VOCs	ND	ND	ND	188.4	264.2	ND	30.0	ND	ND	500
BNAs (ug/L)										
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	600
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	600
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	75
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
Bis(2-ethylhexyl)phthalate	ND	ND	60.0	ND	ND	ND	ND	ND	ND	30
Diethyl Phthalate	ND	ND	ND	ND	1.6	1.7	ND	ND	ND	5000
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	ND	100
Naphthalene	ND	ND	ND	ND	3.3	ND	ND	ND	ND	NCA
Phenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	4000
TOTAL BNAs	ND	ND	60.0	ND	4.9	1.7	ND	ND	ND	NCA

Notes: See Page 12 of 12.

TABLE 5-2
1992 DAMES & MOORE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-43	MW-44	MW-45	MW-46A	MW-47A	MW-48A	MW-48B	MW-49	MW-50	NJDEP GWQS
PESTICIDES (ug/L)										
BHC, A	ND	0.25	ND	ND	ND	ND	ND	ND	ND	0.02
BHC, B	ND	0.13	ND	ND	ND	ND	ND	ND	ND	0.2
DDT, PP	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1
METALS (ug/L)										
Arsenic	ND	9.3	2.3	3	15.3	8.5	ND	ND	173	8
Barium	101	32	70.1	42.1	43	104	51	82.1	58.8	2000
Cadmium	ND	ND	ND	ND	23	6	ND	ND	ND	4
Chromium	ND	13	9	18.6	ND	35	ND	ND	45	100
Lead	7.8	4.9	11.9	4.7	3.6	12.1	2.8	ND	43.9	10
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	4.1	50
Silver	ND	18	ND	ND	ND	ND	ND	ND	ND	NCA
Cyanide	NA	ND	2	NA	NA	NA	NA	NA	NA	200
EXPLOSIVES (ug/L)										
1,3,5-trinitrobenzene	ND	ND	ND	ND	0.368	ND	ND	ND	ND	NCA
1,3-Dinitrobenzene	ND	ND	0.789	ND	ND	ND	ND	ND	ND	NCA
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
HMX	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Nitroglycerin	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
PETN	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
RDX	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Thiodiglycol	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA

Notes: See Page 12 of 12.

TABLE 5-2
1992 DAMES & MOORE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-51	MW-52A	MW-52B	MW-53	MW-54	MW-55A	MW-55B	MW-56	MW-57	NJDEP GWQS
VOCs (ug/L)										
1,1,1-TCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	30
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
1,1-DCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	70
1,2-DCA	ND	ND	ND	ND	ND	ND	ND	ND	ND	2
1,2-DCE-total	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
Acetone	ND	ND	58.0	ND	ND	ND	ND	ND	ND	700
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Bromodichloromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	50
Chloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Chloroform	ND	ND	5.2	ND	ND	ND	ND	ND	ND	6
Ethylbenzene	ND	ND	1.5	ND	ND	ND	ND	ND	ND	700
TCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	1000
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	5
Xylenes (Total)	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
TOTAL VOCs	ND	ND	64.7	ND	ND	ND	ND	ND	ND	500
BNAs (ug/L)										
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	600
1,3-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	600
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	75
2-Chlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	ND	40
Bis(2-ethylhexyl)phthalate	2.2	ND	6.0	ND	3.8	1.8	ND	1.6	2.9	30
Diethyl Phthalate	ND	ND	ND	3.4	9.8	ND	ND	ND	ND	5000
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	ND	100
Naphthalene	ND	ND	2.1	ND	ND	ND	ND	ND	ND	NCA
Phenol	ND	ND	9.6	ND	ND	ND	ND	ND	ND	4000
TOTAL BNAs	2.2	ND	17.7	3.4	13.6	1.8	ND	1.6	2.9	NCA

Notes: See Page 12 of 12.

TABLE 5-2
1992 DAMES & MOORE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-51	MW-52A	MW-52B	MW-53	MW-54	MW-55A	MW-55B	MW-56	MW-57	NJDEP GWQS
PESTICIDES (ug/L)										
BHC, A	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.02
BHC, B	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2
DDT, PP	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1
METALS (ug/L)										
Arsenic	17.1	ND	10.2	3.4	12.7	ND	ND	ND	ND	8
Barium	227	44	55.9	78	145	100	39.8	19.3	50.3	2000
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	4
Chromium	10.7	ND	17.7	ND	131	11.8	ND	ND	ND	100
Lead	ND	ND	3.8	ND	48.5	13.2	ND	ND	ND	10
Mercury	ND	ND	ND	ND	ND	ND	ND	2.2	ND	2
Selenium	2.6	ND	ND	ND	ND	ND	ND	ND	ND	50
Silver	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	200
EXPLOSIVES (ug/L)										
1,3,5-trinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
1,3-Dinitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	10
HMX	ND	ND	3.66	ND	ND	ND	ND	ND	ND	NCA
Nitroglycerin	ND	ND	13.2	ND	ND	ND	ND	ND	ND	NCA
PETN	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
RDX	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA
Thiodiglycol	ND	ND	ND	ND	ND	ND	ND	ND	ND	NCA

Notes: See Page 12 of 12.

TABLE 5-2
1992 DAMES & MOORE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-58	MW-59	MW-60	MW-61	MW-62	MW-63	MW-64	NJDEP GWQS
VOCs (ug/L)								
1,1,1-TCA	ND	ND	ND	ND	ND	ND	9.1	30
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	2
1,1-DCA	ND	170.0	ND	ND	ND	ND	ND	70
1,2-DCA	ND	46.0	ND	ND	ND	ND	ND	2
1,2-DCE-total	68.0	17.0	ND	ND	ND	ND	ND	10
Acetone	ND	ND	ND	ND	ND	15.0	ND	700
Benzene	ND	14.0	ND	ND	ND	ND	ND	1
Bromodichloromethane	ND	ND	ND	ND	3.4	ND	ND	1
Chlorobenzene	ND	270.0	ND	ND	ND	ND	ND	50
Chloroethane	ND	85.0	ND	ND	ND	ND	ND	NCA
Chloroform	ND	ND	ND	ND	35.0	19.0	ND	6
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	700
TCE	170.0	20.0	ND	ND	ND	ND	ND	1
Tetrachloroethene	11.0	ND	ND	ND	ND	ND	ND	1
Toluene	ND	ND	ND	ND	ND	ND	ND	1000
Vinyl chloride	ND	ND	ND	ND	ND	ND	ND	5
Xylenes (Total)	ND	ND	ND	ND	ND	ND	ND	40
TOTAL VOCs	249.0	622.0	ND	ND	38.4	34.0	9.1	500
BNAs (ug/L)								
1,2-Dichlorobenzene	ND	23.0	ND	ND	ND	ND	ND	600
1,3-Dichlorobenzene	ND	1.3	ND	ND	ND	ND	ND	600
1,4-Dichlorobenzene	ND	17.0	ND	ND	ND	ND	ND	75
2-Chlorophenol	ND	2.1	ND	ND	ND	ND	ND	40
Bis(2-ethylhexyl)phthalate	4.0	ND	18.0	2.1	ND	ND	ND	30
Diethyl Phthalate	ND	ND	ND	ND	1.2	ND	ND	5000
Isophorone	ND	ND	ND	ND	6.7	5.4	ND	100
Naphthalene	ND	ND	ND	ND	ND	ND	ND	NCA
Phenol	ND	ND	ND	ND	ND	8.4	ND	4000
TOTAL BNAs	4.0	43.4	18.0	2.1	7.9	13.8	ND	NCA

Notes: See Page 12 of 12.

TABLE 5-2
1992 DAMES & MOORE GROUNDWATER ANALYTICAL DATA
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

MONITORING WELL:	MW-58	MW-59	MW-60	MW-61	MW-62	MW-63	MW-64	NJDEP GWQS
PESTICIDES (ug/L)								
BHC, A	ND	ND	ND	ND	ND	ND	ND	0.02
BHC, B	ND	ND	ND	ND	ND	ND	ND	0.2
DDT, PP	0.058	ND	ND	ND	ND	ND	ND	0.1
METALS (ug/L)								
Arsenic	ND	ND	4.3	15.9	3.5	8.4	ND	8
Barium	68	52	435	177	52.5	135	63	2000
Cadmium	ND	17	ND	8	ND	ND	ND	4
Chromium	37	62	ND	25	ND	ND	9.5	100
Lead	7.7	12	ND	3.9	10.9	2.6	3.2	10
Mercury	ND	ND	ND	ND	ND	ND	ND	2
Selenium	ND	ND	ND	ND	ND	ND	ND	50
Silver	ND	ND	ND	ND	ND	ND	ND	NCA
Cyanide	NA	NA	NA	NA	NA	NA	NA	200
EXPLOSIVES (ug/L)								
1,3,5-trinitrobenzene	ND	ND	ND	ND	ND	ND	ND	NCA
1,3-Dinitrobenzene	ND	ND	0.811	ND	ND	ND	ND	NCA
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	10
HMX	ND	ND	ND	ND	ND	ND	ND	NCA
Nitroglycerin	ND	ND	ND	ND	ND	ND	ND	NCA
PETN	ND	ND	22.6	ND	ND	ND	ND	NCA
RDX	ND	ND	ND	ND	ND	1.15	ND	NCA
Thiodiglycol	ND	ND	ND	ND	ND	ND	ND	NCA

Notes: ND: Not detected
NCA: No current criteria available
VOC: Volatile organic compounds
BNAs: Base neutral and acid extractable compounds
NJDEP: New Jersey Department of Environmental Protection
GWQS: Groundwater Quality Standards

TABLE 5-3
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-6 MW-6 19 11/11/94	GW1-MW-6C MW-6C 09 11/11/94	GW1-MW-7 MW-7 01 11/11/94	GW1-MW-8 MW-8 01 11/11/94	GW1-MW-9 MW-9 01 11/11/94	GW1-MW-10 MW-10 20 11/10/94	GW1-MW-11 MW-11 07 11/8/94	GW1-MW-12 MW-12 07 11/10/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	14.00	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	4.00	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	82.00	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	3.00	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	3.00	14.00	6.00	1.00 U	16.00	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	5.00	82.00	2.00	1.00 U	9.00	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	4.00	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
[shaded] : The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-3
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-13 MW-13 02 11/9/94	GW1-MW-14 MW-14 03 11/11/94	GW1-MW-15 MW-15 03 11/10/94	GW1-MW-16 MW-16 06A 11/16/94	GW1-MW-17 MW-17 04 11/15/94	GW1-MW-18 MW-18 04 11/10/94	GW1-MW-19 MW-19 04 11/11/94	GW1-MW-20 MW-20 05 11/16/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	10.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	72.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	10.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	10.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	10.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	180.00	2.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	300.00	7.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	20.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

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Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
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TABLE 5-3
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-21 MW-21 05 11/17/94	GW1-MW-22 MW-22 05 11/16/94	GW1-MW-25 MW-25 86A 11/15/94	GW1-MW-26 MW-26 86A 11/16/94	GW1-MW-27 MW-27 86A 11/16/94	GW1-MW-28 MW-28 11 11/15/94	GW1-MW-28B MW-28B 11 11/15/94	GW1-MW-29 MW-29 11 11/15/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
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TABLE 5-3
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-30 MW-30 11 11/15/94	GW1-MW-31 MW-31 01 11/11/94	GW1-MW-34 MW-34 06B 11/16/94	GW1-MW-42A MW-42A 04 11/14/94	GW1-MW-43 MW-43 04 11/11/94	GW1-MW-44 MW-44 06A 11/15/94	GW1-MW-45 MW-45 14 11/16/94	GW1-MW-46A MW-46A 10 11/9/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.80	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	13.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	120.00	10
TRICHLOROETHYLENE (TCE)	1.00 U	48.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	27.00	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	13.00	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
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TABLE 5-3
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-47A MW-47A 09 11/9/94	GW1-MW-47C MW-47C 09 11/10/94	GW1-MW-48A MW-48A 09 11/11/94	GW1-MW-48B MW-48B 09 11/11/94	GW1-MW-49 MW-49 19 11/9/94	GW1-MW-201C Dup of MW-49C 19 11/9/94	GW1-MW-49C MW-49C 19 11/9/94	GW1-MW-50 MW-50 14 11/15/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	2
BENZENE	7.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	16.00	3.00	1.00 U	1.00 U	1.00 U	10.00 U	1
TOTAL-1,2-DICHLOROETHENE	110.00	1.00 U	9.00	6.00	1.00 U	1.00 U	1.00 U	10.00 U	10
TRICHLOROETHYLENE (TCE)	30.00	1.00 U	8.00	24.00	1.00 U	1.00 U	1.00 U	10.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	20.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
[shaded]: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
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TABLE 5-3
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-50B MW-50B 14 11/15/94	GW1-MW-50C MW-50C 14 11/15/94	GW1-MW-51 MW-51 16 11/14/94	GW1-MW-52A MW-52A 16 11/15/94	GW1-MW-52B MW-52B 16 11/15/94	GW1-MW-53 MW-53 16 11/14/94	GW1-MW-54 MW-54 19 11/14/94	GW1-MW-56 MW-56 10 11/9/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	1.00 U	10.00 U	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	20.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
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TABLE 5-3
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-57 MW-57 10 11/9/94	GW1-MW-58 MW-58 03 11/8/94	GW1-MW-59 MW-59 07 11/10/94	GW1-MW-59C MW-59C 07 11/10/94	GW1-MW-202 Dup of MW-59C 07 11/10/94	GW1-MW-60 MW-60 14 11/14/94	GW1-MW-60B MW-60B 14 11/14/94	GW1-MW-60C MW-60C 14 11/18/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	16.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	50.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	450.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	13.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	21.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	110.00	13.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	15.00	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

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Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
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TABLE 5-3
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NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-61 MW-61 04 11/17/94	GW1-MW-62 MW-62 06 11/11/94	GW1-MW-63 MW-63 12 11/15/94	GW1-MW-63A MW-63A 14 11/15/94	GW1-MW-65 MW-65 05 11/16/94	GW1-MW-66 MW-66 05 11/16/94	GW1-MW-67 MW-67 05 11/16/94	GW1-MW-69A MW-69A XHW 11/9/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

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Dup.: QC duplicate sample of the well indicated.
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ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
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NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-70A MW-70A 10 11/9/94	GW1-MW-71C MW-71C 18A 11/10/94	GW1-MW-75A MW-75A 04 11/11/94	GW1-MW-75C MW-75C 04 11/11/94	GW1-MW-76A MW-76A 04 11/10/94	GW1-MW-76B MW-76B 04 11/11/94	GW1-MW-76C MW-76C 04 11/10/94	GW1-MW-77A MW-77A 14 11/8/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

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ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
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NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-77B MW-77B 14 11/8/94	GW1-MW-78A MW-78A 14 11/8/94	GW1-MW-79B MW-79B 08 11/14/94	GW1-MW-79C MW-79C 08 11/14/94	GW1-MW-80A MW-80A 09 11/14/94	GW1-MW-203A Dup of MW-80A 09 11/14/94	GW1-MW-81A MW-81A 151 11/8/94	GW1-MW-82A MW-82A OI 11/8/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	31.00 J	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	260.00	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	1.00 U	11.00	11.00	590.00	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	10.00 J	2.00 U	5

Notes:

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NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-83A MW-83A 15 11/8/94	GW1-MW-84A MW-84A 15 11/8/94	GW1-MW-85A MW-85A 15 11/8/94	GW1-MW-200A Dup of MW-85A 15 11/8/94	GW1-MW-86A MW-86A 15 11/8/94	GW1-MW-86C MW-86C 15 11/8/94	GW1-MW-87A MW-87A 18D 11/9/94	GW1-MW-87C MW-87C 18D 11/9/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2.00	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2.00	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00	18.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	8.00	1.00 U	1.00 U	1.00 U	1.00 U	7.00	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

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Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
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NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-88A MW-88A 18C 11/10/94	GW1-MW-88C MW-88C 18C 11/10/94	GW1-MW-89A MW-89A 01 11/18/94	GW1-MW-89C MW-89C 01 11/17/94	GW1-MW-90A MW-90A 16 11/14/94	GW1-MW-90B MW-90B 16 11/14/94	GW1-MW-90C MW-90C 16 11/18/94	GW1-MW-91A MW-91A 16 11/15/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	17.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	3.00	10
TRICHLOROETHYLENE (TCE)	4.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	28.00	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-3
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-91B MW-91B 16 11/15/94	GW1-MW-92B MW-92B 16 11/14/94	GW1-MW-93A MW-93A 16 11/15/94	GW1-MW-93B MW-93B 16 11/15/94	GW1-MW-285B Dup of MW-93B 16 11/15/94	GW1-MW-94A MW-94A/G 06 11/17/94	GW1-MW-95A MW-95A/G 06 11/17/94	GW1-MW-96A MW-96A 06 11/17/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	13.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	3.00	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-3
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-96C MW-96C 06 11/17/94	GW1-MW-97A MW-97A 06A 11/16/94	GW1-MW-97B MW-97B 06B 11/17/94	GW1-MW-207B Dup of MW-97B 06B 11/17/94	GW1-MW-98A MW-98A 06B 11/16/94	GW1-MW-98B MW-98B 06B 11/16/94	GW1-MW-99A MW-99A 06B 11/16/94	GW1-MW-99B MW-99B 06B 11/16/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-3
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-100A MW-100A 11 11/14/94	GW1-MW-101A MW-101A 11 11/14/94	GW1-MW-103A MW-103A BKG 11/17/94	GW1-MW-103C MW-103C BKG 11/18/94	GW1-MW-104A MW-104A BKG 11/17/94	GW1-MW-104C MW-104C BKG 11/17/94	GW1-MW-105A MW-105A BKG 11/9/94	GW1-MW-105C MW-105C BKG 11/9/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	8.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	40.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	7.00	1.00 U	1.00 U	1.00 U	4.00	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-3
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-EPA2A MW-EPA2A 18A 11/10/94	GW1-MW-SA4 MW-SA4 151 11/8/94	GW1-MW-SA5 MW-SA5 151 11/10/94	GW1-MW-SPCI-4 MW-SPCI4 151 11/8/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	22.00	22.00	1
TOTAL-1,2-DICHLOROETHENE	180.00	1.00 U	220.00	36.00	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	240.00	150.00	1
VINYL CHLORIDE	38.00	4.00	16.00	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-4
ANALYTICAL GROUNDWATER SVOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	WELL ID	AREA*	DATE COLLECTED	BIS(2-ETHYLHEXYL) PHTHALATE (ug/l)	NJDEP GROUNDWATER QUALITY STANDARD (ug/l)
GW1-MW-6	MW-6	19	11/11/94	11 U	30
GW1-MW-6C	MW-6C	09	11/11/94	11 U	30
GW1-MW-7	MW-7	01	11/11/94	10 U	30
GW1-MW-8	MW-8	01	11/11/94	10 U	30
GW1-MW-9	MW-9	01	11/11/94	11 U	30
GW1-MW-10	MW-10	20	11/10/94	11 U	30
GW1-MW-11	MW-11	07	11/8/94	10 U	30
GW1-MW-12	MW-12	07	11/10/94	11 U	30
GW1-MW-13	MW-13	02	11/9/94	12 U	30
GW1-MW-14	MW-14	03	11/11/94	10 U	30
GW1-MW-15	MW-15	03	11/10/94	10 U	30
GW1-MW-16	MW-16	06A	11/16/94	11 U	30
GW1-MW-17	MW-17	04	11/15/94	12 U	30
GW1-MW-18	MW-18	04	11/10/94	11 U	30
GW1-MW-19	MW-19	04	11/11/94	11 U	30
GW1-MW-20	MW-20	05	11/16/94	10 U	30
GW1-MW-21	MW-21	05	11/17/94	11 U	30
GW1-MW-22	MW-22	05	11/16/94	11 U	30
GW1-MW-25	MW-25	06A	11/15/94	11 U	30
GW1-MW-26	MW-26	06A	11/16/94	11 U	30
GW1-MW-27	MW-27	06A	11/16/94	10 U	30
GW1-MW-28	MW-28	11	11/15/94	12 U	30
GW1-MW-28B	MW-28B	11	11/15/94	10 U	30
GW1-MW-29	MW-29	11	11/15/94	11 U	30
GW1-MW-30	MW-30	11	11/15/94	11 U	30
GW1-MW-31	MW-31	01	11/11/94	11 U	30
GW1-MW-34	MW-34	06B	11/16/94	10 U	30
GW1-MW-42A	MW-42A	04	11/14/94	10 U	30
GW1-MW-43	MW-43	04	11/11/94	11 U	30
GW1-MW-44	MW-44	06A	11/15/94	11 U	30
GW1-MW-45	MW-45	14	11/16/94	11 U	30
GW1-MW-46A	MW-46A	10	11/9/94	11 U	30
GW1-MW-47A	MW-47A	09	11/9/94	11 U	30
GW1-MW-47C	MW-47C	09	11/10/94	10 U	30
GW1-MW-48A	MW-48A	09	11/11/94	11 U	30
GW1-MW-48B	MW-48B	09	11/11/94	11 U	30
GW1-MW-49	MW-49	19	11/9/94	11 U	30
GW1-MW-49C	MW-49C	19	11/9/94	11 U	30
GW1-MW-201C	Dup. of MW-49C	19	11/9/94	11 U	30
GW1-MW-50	MW-50	14	11/15/94	11 U	30
GW1-MW-50B	MW-50B	14	11/15/94	11 U	30
GW1-MW-50C	MW-50C	14	11/15/94	10 U	30
GW1-MW-51	MW-51	16	11/14/94	10 U	30
GW1-MW-52A	MW-52A	16	11/15/94	10 U	30
GW1-MW-52B	MW-52B	16	11/15/94	11 U	30
GW1-MW-53	MW-53	16	11/14/94	11 U	30
GW1-MW-53	MW-53	16	11/18/94	11 U	30
GW1-MW-54	MW-54	19	11/14/94	28	30
GW1-MW-56	MW-56	10	11/9/94	11 U	30
GW1-MW-57	MW-57	10	11/9/94	11 U	30
GW1-MW-58	MW-58	03	11/8/94	11 U	30
GW1-MW-59	MW-59	07	11/10/94	10 U	30
GW1-MW-59C	MW-59C	07	11/10/94	11 U	30
GW1-MW-202	Dup. of MW-59C	07	11/10/94	10 U	30

Notes: See Page 3 of 3.

TABLE 5-4
ANALYTICAL GROUNDWATER SVOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	WELL ID	AREA*	DATE COLLECTED	BIS(2-ETHYLHEXYL) PHTHALATE (ug/l)	NJDEP GROUNDWATER QUALITY STANDARD (ug/l)
GW1-MW-60	MW-60	14	11/14/94	11 U	30
GW1-MW-60B	MW-60B	14	11/14/94	11 U	30
GW1-MW-60C	MW-60C	14	11/18/94	11 U	30
GW1-MW-61	MW-61	04	11/17/94	10 U	30
GW1-MW-62	MW-62	06	11/11/94	10 U	30
GW1-MW-63	MW-63	12	11/15/94	11 U	30
GW1-MW-63A	MW-63A	14	11/15/94	12 U	30
GW1-MW-65	MW-65	05	11/16/94	11 U	30
GW1-MW-66	MW-66	05	11/16/94	10 U	30
GW1-MW-67	MW-67	05	11/16/94	140	30
GW1-MW-69A	MW-69A	XHW	11/9/94	10 U	30
GW1-MW-70A	MW-70A	10	11/9/94	10 U	30
GW1-MW-71C	MW-71C	18A	11/10/94	10 U	30
GW1-MW-75A	MW-75A	04	11/11/94	11 U	30
GW1-MW-75C	MW-75C	04	11/11/94	11 U	30
GW1-MW-76A	MW-76A	04	11/10/94	27 U	30
GW1-MW-76B	MW-76B	04	11/11/94	11 U	30
GW1-MW-76C	MW-76C	04	11/10/94	10 U	30
GW1-MW-77A	MW-77A	14	11/8/94	12 U	30
GW1-MW-77B	MW-77B	14	11/8/94	10 U	30
GW1-MW-78A	MW-78A	14	11/8/94	10 U	30
GW1-MW-79B	MW-79B	08	11/14/94	11 U	30
GW1-MW-79C	MW-79C	08	11/14/94	10 U	30
GW1-MW-80A	MW-80A	09	11/14/94	10 U	30
GW1-MW-203A	Dup. of MW-80A	09	11/14/94	18 U	30
GW1-MW-81A	MW-81A	151	11/8/94	10 U	30
GW1-MW-82A	MW-82A	OI	11/8/94	11 U	30
GW1-MW-83A	MW-83A	15	11/8/94	10 U	30
GW1-MW-84A	MW-84A	15	11/8/94	10 U	30
GW1-MW-85A	MW-85A	15	11/8/94	11 U	30
GW1-MW-200A	Dup. of MW-85A	15	11/8/94	11 U	30
GW1-MW-86A	MW-86A	15	11/8/94	11 U	30
GW1-MW-86C	MW-86C	15	11/8/94	10 U	30
GW1-MW-87A	MW-87A	18D	11/9/94	10 U	30
GW1-MW-87C	MW-87C	18D	11/9/94	11 U	30
GW1-MW-88A	MW-88A	18C	11/10/94	11 U	30
GW1-MW-88C	MW-88C	18C	11/10/94	10 U	30
GW1-MW-89A	MW-89A	01	11/18/94	12 U	30
GW1-MW-89C	MW-89C	01	11/17/94	7 J	30
GW1-MW-90A	MW-90A	16	11/14/94	11 U	30
GW1-MW-90B	MW-90B	16	11/14/94	11 U	30
GW1-MW-90C	MW-90C	16	11/18/94	72	30
GW1-MW-91A	MW-91A	16	11/15/94	12 U	30
GW1-MW-91B	MW-91B	16	11/15/94	11 U	30
GW1-MW-92B	MW-92B	16	11/14/94	11 U	30
GW1-MW-93A	MW-93A	16	11/15/94	11 U	30
GW1-MW-93B	MW-93B	16	11/15/94	11 U	30
GW1-MW-205B	Dup. of MW-93B	16	11/15/94	10 U	30
GW1-MW-94A	MW-94A/O	06	11/17/94	11 U	30
GW1-MW-95A	MW-95A/O	06	11/17/94	6 J	30
GW1-MW-96A	MW-96A	06	11/17/94	3 J	30
GW1-MW-96C	MW-96C	06	11/17/94	10 U	30
GW1-MW-97A	MW-97A	06A	11/16/94	11 U	30
GW1-MW-97B	MW-97B	06B	11/17/94	11 U	30
GW1-MW-207B	Dup. of MW-97B	06B	11/17/94	11 U	30
GW1-MW-98A	MW-98A	06B	11/16/94	11 U	30

Notes: See Page 3 of 3.

TABLE 5-4
ANALYTICAL GROUNDWATER SVOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	WELL ID	AREA*	DATE COLLECTED	BIS(2-ETHYLHEXYL) PHTHALATE (ug/l)	NJDEP GROUNDWATER QUALITY STANDARD (ug/l)
GW1-MW-98B	MW-98B	06B	11/16/94	11 U	30
GW1-MW-99A	MW-99A	06B	11/16/94	11 U	30
GW1-MW-99B	MW-99B	06B	11/16/94	9 J	30
GW1-MW-100A	MW-100A	11	11/14/94	11 U	30
GW1-MW-101A	MW-101A	11	11/14/94	10 U	30
GW1-MW-103A	MW-103A	BKG	11/17/94	3 J	30
GW1-MW-103C	MW-103C	BKG	11/18/94	14 U	30
GW1-MW-104A	MW-104A	BKG	11/17/94	7 J	30
GW1-MW-104C	MW-104C	BKG	11/17/94	2 J	30
GW1-MW-105A	MW-105A	BKG	11/9/94	10 U	30
GW1-MW-105C	MW-105C	BKG	11/9/94	10 U	30
GW1-MW-EPA2A	MW-EPA2A	18A	11/10/94	11 U	30
GW1-MW-SA4	MW-SA4	151	11/8/94	11 U	30
GW1-MW-SA5	MW-SA5	151	11/10/94	11 U	30
GW1-MW-SPCI-4	MW-SPCI4	151	11/8/94	10 U	30

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
[shaded box]: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-6 MW-6 19 11/11/94	GW1-MW-6C MW-6C 09 11/11/94	GW1-MW-7 MW-7 01 11/11/94	GW1-MW-8 MW-8 01 11/11/94	GW1-MW-9 MW-9 01 11/11/94	GW1-MW-10 MW-10 20 11/10/94	GW1-MW-11 MW-11 07 11/8/94	GW1-MW-12 MW-12 07 11/10/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	NA	NA	NA	630.0 J	NA	NA	1840.0	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	4.8	1.7 U	6.5	1.7 U	2.1	2.7	1.7 U	1.7 U	8
CADMIUM	1.0 U	1.0 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	4
CHROMIUM	6.4 U	7.7	12.9	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	100
IRON	NA	NA	NA	NA	3560.0	NA	NA	2680.0	300
LEAD	1.6 U	2.3	6.9	3.9	5.2	4.2 U	1.8 U	6.7 U	10
MANGANESE	NA	NA	NA	NA	94.4	NA	NA	113.0	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.3 J	0.2 U	2
NICKEL	12.8 U	12.8 U	47.7	32.0	16.8	12.8 U	12.8 U	12.8 U	100
SODIUM	NA	NA	NA	NA	18900.0	NA	NA	36900.0	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-13 MW-13 02 11/9/94	GW1-MW-14 MW-14 03 11/11/94	GW1-MW-15 MW-15 03 11/10/94	GW1-MW-16 MW-16 06A 11/16/94	GW1-MW-17 MW-17 04 11/15/94	GW1-MW-18 MW-18 04 11/10/94	GW1-MW-19 MW-19 04 11/11/94	GW1-MW-20 MW-20 05 11/16/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	3480.0 J	253.0	NA	NA	NA	388.0 J	NA	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	17.6 U	11.0 U	20
ARSENIC	1.7 U	1.7 U	1.7 U	8.2 J-	4.3 J-	1.7 U	1.7 U	1.7 UJ	8
CADMIUM	1.0 U	2.8	1.0 U	1.0 U	2.0 U	1.0 U	2.0 U	1.1	4
CHROMIUM	6.4 U	6.4 U	6.4 U	8.9	6.4 U	6.4 U	6.4 U	6.4 U	100
IRON	NA	31.6 U	42500.0	NA	NA	NA	72300.0	NA	300
LEAD	2.4 U	3.4	2.8 U	1.6 UJ	1.6 UJ	2.3 U	2.4	4.2 U	10
MANGANESE	NA	83.9	1990.0	NA	NA	NA	2330.0	NA	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	22.6	12.8 U	12.8 U	44.7	12.8 U	27.3	37.2	100
SODIUM	NA	145000.0	68000.0	NA	NA	NA	227000.0	NA	50000

Notes:

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J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
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: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
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TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-21 MW-21 05 11/17/94	GW1-MW-22 MW-22 05 11/16/94	GW1-MW-25 MW-25 06A 11/15/94	GW1-MW-26 MW-26 06A 11/16/94	GW1-MW-27 MW-27 06A 11/16/94	GW1-MW-28 MW-28 11 11/15/94	GW1-MW-28B MW-28B 11 11/15/94	GW1-MW-29 MW-29 11 11/15/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	214.0 J	825.0	NA	NA	9810.0	NA	NA	NA	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	17.6 U	20
ARSENIC	1.7 U	1.7 UJ	12.8 J-	1.7 UJ	16.2 J-	29.2 J-	8.5 UJ	66.4 J-	8
CADMIUM	2.2	3.2	1.0 U	1.0 U	1.0 U	2.0 U	1.0 U	1.0 U	4
CHROMIUM	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	100
IRON	1320.0	12200.0	NA	NA	94600.0	NA	NA	NA	300
LEAD	1.6 UJ	2.6 U	1.6 UJ	3.5 U	1.6 UJ	1.6 UJ	1.6 UJ	1.6 UJ	10
MANGANESE	1670.0	740.0	NA	NA	1040.0	NA	NA	NA	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	47.9	12.8 U	12.8 U	12.8 U	27.2	12.8 U	12.8 U	12.8 U	100
SODIUM	41900.0	49000.0	NA	NA	52700.0	NA	NA	NA	50000

Notes:

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J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
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TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-30 MW-30 11 11/15/94	GW1-MW-31 MW-31 01 11/11/94	GW1-MW-34 MW-34 06B 11/16/94	GW1-MW-42A MW-42A 04 11/14/94	GW1-MW-43 MW-43 04 11/11/94	GW1-MW-44 MW-44 06A 11/15/94	GW1-MW-45 MW-45 14 11/16/94	GW1-MW-46A MW-46A 10 11/9/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	NA	36.4 U	NA	NA	NA	NA	2060.0 J	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	17.6 U	17.6 U	11.0 U	11.0 U	20
ARSENIC	78.0 J-	1.7 U	1.8 J-	6.1 J	1.7 U	1.7 UJ	3.1 J-	1.7 U	8
CADMIUM	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	4
CHROMIUM	6.4 U	6.4 U	6.4 U	6.4 U	14.5	6.4 U	6.4 U	6.4 U	100
IRON	NA	NA	834.0	NA	NA	NA	NA	3220.0	300
LEAD	1.6 UJ	3.3	1.6 UJ	1.6 U	13.7	1.8 J-	3.8 U	2.9 U	10
MANGANESE	NA	NA	639.0	NA	NA	NA	NA	72.1	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	28.9	12.8 U	17.0	13.7	12.8 U	12.8 U	12.8 U	100
SODIUM	NA	NA	261000.0	NA	NA	NA	NA	17500.0	50000

Notes:

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J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
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TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-47A MW-47A 09 11/9/94	GW1-MW-47C MW-47C 09 11/10/94	GW1-MW-48A MW-48A 09 11/11/94	GW1-MW-48B MW-48B 09 11/11/94	GW1-MW-49 MW-49 19 11/9/94	GW1-MW-49C MW-49C 19 11/9/94	GW1-MW-201C Dup of MW-49C 19 11/9/94	GW1-MW-50 MW-50 14 11/15/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	26.7 U	NA	92.7 U	1570.0 J	NA	NA	667.0	200
ANTIMONY	11.0 U	17.6 U	11.0 U	11.0 U	11.0 U	11.0 U	11 U	13.0	20
ARSENIC	7.6	2.4	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	396.0 J-	8
CADMIUM	1.0 U	1.0 U	1.2	2.0 U	1.0 U	1.0 U	1 U	1.0 U	4
CHROMIUM	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	26.1	100
IRON	NA	5060.0	NA	40900.0	2250.0	NA	NA	18500.0	300
LEAD	3.5 U	1.6 UJ	2.9	1.6 U	1.6 UJ	1.6 UJ	1.6 UJ	6.1 J-	10
MANGANESE	NA	230.0	NA	666.0	172.0	NA	NA	49.9	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.3	2
NICKEL	151.0	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	100
SODIUM	NA	17600.0	NA	54500.0	8220.0	NA	NA	358000.0	50000

Notes:

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J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
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TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-50B MW-50B 14 11/15/94	GW1-MW-50C MW-50C 14 11/15/94	GW1-MW-51 MW-51 16 11/14/94	GW1-MW-52A MW-52A 16 11/15/94	GW1-MW-52B MW-52B 16 11/15/94	GW1-MW-53 MW-53 16 11/14/94	GW1-MW-54 MW-54 19 11/14/94	GW1-MW-56 MW-56 10 11/9/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	NA	NA	NA	41.6 U	NA	NA	119.0 J	200
ANTIMONY	11.0 U	11.0 U	17.6 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	5.3 J-	8.5 UJ	21.5 J	4.3 J-	9.1 J-	4.9 J-	6.6 J	1.7 U	8
CADMIUM	1.0 U	1.0 U	1.0 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	4
CHROMIUM	6.4 U	6.4 U	6.4 U	7.6	6.4 U	8.6	50.5 J	6.4 U	100
IRON	NA	NA	NA	NA	10400.0	NA	NA	6410.0	300
LEAD	1.6 UJ	1.8 J-	1.6 U	14.5 J-	1.6 UJ	2.7 U	12.5 U	3.2 U	10
MANGANESE	NA	NA	NA	NA	84.0	NA	NA	161.0	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	20.5	12.8 U	100
SODIUM	NA	NA	NA	NA	2790000.0	NA	NA	11300.0	50000

Notes:

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J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
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TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-57 MW-57 10 11/9/94	GW1-MW-58 MW-58 03 11/8/94	GW1-MW-59 MW-59 07 11/10/94	GW1-MW-59C MW-59C 07 11/10/94	GW1-MW-202 Dup of MW-59C 07 11/10/94	GW1-MW-60 MW-60 14 11/14/94	GW1-MW-60B MW-60B 14 11/14/94	GW1-MW-60C MW-60C 14 11/18/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	4400.0 J	2210.0	NA	83.8 U	82.6 U	NA	NA	132.0	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11 U	11.0 U	17.6 U	27.2	20
ARSENIC	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	5.2 J	13.8 J	2.0	8
CADMIUM	1.1	1.4	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.2	4
CHROMIUM	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	100
IRON	234.0	311.0 U	NA	500.0	478	NA	NA	1220.0	300
LEAD	11.1 J-	1.6 U	2.0 U	4.7 U	3.2 U	1.6 U	1.6 U	1.6 UJ	10
MANGANESE	160.0	49.3	NA	48.9	46.5	NA	NA	122.0	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	30.8	15.0	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	100
SODIUM	7790.0	6100.0	NA	27900.0	27400	NA	NA	3530000.0	50000

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Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
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TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-61 MW-61 04 11/17/94	GW1-MW-62 MW-62 06 11/11/94	GW1-MW-63 MW-63 12 11/15/94	GW1-MW-63A MW-63A 14 11/15/94	GW1-MW-65 MW-65 05 11/16/94	GW1-MW-66 MW-66 05 11/16/94	GW1-MW-67 MW-67 05 11/16/94	GW1-MW-68A MW-68A 11B 11/9/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	51.5 U	147.0 U	NA	NA	386.0	NA	NA	200
ANTIMONY	11.0 U	17.6 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	18.9	2.6	34.0 UJ	2.0 J-	3.0 J-	1.7 UJ	17.1 J-	1.7 U	8
CADMIUM	1.0 U	2.0 U	1.0 U	1.0 U	1.2	4.0	2.0 U	1.0 U	4
CHROMIUM	13.8	11.8	6.4 U	29.7	6.4 U	6.4 U	6.4 U	10.2	100
IRON	NA	7370.0	37800.0	NA	NA	173.0 U	NA	NA	300
LEAD	2.0 U	1.6 U	1.6 UJ	10.4 J-	1.6 UJ	1.6 UJ	15.7 U	2.3 U	10
MANGANESE	NA	8000.0	199.0	NA	NA	1420.0	NA	NA	50
MERCURY	0.2 U	0.2 U	0.2	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	12.8 U	12.8 U	13.5	20.8	64.4	12.8 U	18.0	100
SODIUM	NA	5770000.0	5140000.0	NA	NA	49400.0	NA	NA	50000

Notes:

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J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
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TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-69A MW-69A XHW 11/9/94	GW1-MW-70A MW-70A 18 11/9/94	GW1-MW-71C MW-71C 18A 11/10/94	GW1-MW-75A MW-75A 04 11/11/94	GW1-MW-75C MW-75C 04 11/11/94	GW1-MW-76A MW-76A 04 11/10/94	GW1-MW-76B MW-76B 04 11/11/94	GW1-MW-76C MW-76C 04 11/10/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	NA	49.2 U	NA	NA	3950.0	NA	NA	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	3.4	1.7 U	1.7 U	1.7 U	1.7 U	3.6	9.7	1.7 U	8
CADMIUM	1.2	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	4
CHROMIUM	83.2	6.4 U	6.4 U	7.9	6.4 U	34.0	6.4 U	6.4 U	100
IRON	NA	NA	2240.0	NA	NA	28500.0	NA	NA	300
LEAD	31.6 J-	4.0 U	5.6 U	1.6 U	1.6 U	20.3	3.9	3.6 U	10
MANGANESE	NA	NA	129.0	NA	NA	694.0	NA	NA	50
MERCURY	0.3	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	49.2	12.8 U	12.8 U	33.4	12.8 U	12.8 U	12.8 U	12.8 U	100
SODIUM	NA	NA	40500.0	NA	NA	107000.0	NA	NA	50000

Notes:

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J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
[shaded] : The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
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TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-77A MW-77A 14 11/8/94	GW1-MW-77B MW-77B 14 11/8/94	GW1-MW-78A MW-78A 14 11/8/94	GW1-MW-79B MW-79B 08 11/14/94	GW1-MW-79C MW-79C 08 11/14/94	GW1-MW-80A MW-80A 09 11/14/94	GW1-MW-203A Dup of MW-80A 09 11/14/94	GW1-MW-81A MW-81A 151 11/8/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	2250.0	NA	NA	NA	176.0 U	NA	NA	NA	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11 U	11.0 U	20
ARSENIC	17.0	7.2	4.7	5.2 J	1.7 UJ	1.7 UJ	1.7 UJ	1.7 U	8
CADMIUM	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.4	1.5	1.0 U	4
CHROMIUM	6.4 U	6.1	23.7	6.4 U	6.4 U	6.4 U	11.4 J	6.4 U	100
IRON	26300.0	NA	NA	NA	5450.0	NA	NA	NA	300
LEAD	2.9	7.1	3.4	1.6 U	2.0 U	6.0 U	5.8 U	1.9	10
MANGANESE	1050.0	NA	NA	NA	1690.0	NA	NA	NA	50
MERCURY	0.2 U	0.3 J	0.2 UJ	0.2 U	0.2 U	0.2 U	0.2 U	0.2 UJ	2
NICKEL	13.2	14.6	22.9	12.8 U	12.8 U	13.9	22.4	14.9	100
SODIUM	326000.0	NA	NA	NA	139000.0	NA	NA	NA	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
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TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-82A MW-82A OI 11/8/94	GW1-MW-83A MW-83A 15 11/8/94	GW1-MW-84A MW-84A 15 11/8/94	GW1-MW-85A MW-85A 15 11/8/94	GW1-MW-200A Dup of MW-85A 15 11/8/94	GW1-MW-86A MW-86A 15 11/8/94	GW1-MW-86C MW-86C 15 11/8/94	GW1-MW-87A MW-87A 18D 11/9/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	414.0	NA	NA	NA	NA	NA	36.8 U	NA	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	17.6 U	11.0 U	20
ARSENIC	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	8
CADMIUM	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	4
CHROMIUM	8.5	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	100
IRON	539.0	NA	NA	NA	NA	NA	1270.0	NA	300
LEAD	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 U	1.6 UJ	10
MANGANESE	120.0	NA	NA	NA	NA	NA	63.2	NA	50
MERCURY	0.2 U	0.2 UJ	0.2 UJ	0.2 J	3.0 J	0.2 UJ	0.2 U	0.2 U	2
NICKEL	12.8 U	50.5	39.5	55.1	46.1	75.9	12.8 U	12.8 U	100
SODIUM	2540.0	NA	NA	NA	NA	NA	22100.0	NA	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-87C MW-87C 18D 11/9/94	GW1-MW-88A MW-88A 18C 11/10/94	GW1-MW-88C MW-88C 18C 11/10/94	GW1-MW-89A MW-89A 01 11/18/94	GW1-MW-89C MW-89C 01 11/17/94	GW1-MW-90A MW-90A 16 11/14/94	GW1-MW-90B MW-90B 16 11/14/94	GW1-MW-90C MW-90C 16 11/18/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	NA	240.0	NA	NA	405.0 U	NA	2050.0	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	1.7 U	1.7 U	1.7 U	2.3 J-	1.7 U	11.7 J	1.7 UJ	2.0	8
CADMIUM	1.0 U	1.0 U	1.0 U	2.0 U	1.0 U	1.0 U	2.0 U	1.5	4
CHROMIUM	6.4 U	6.4 U	6.4 U	15.0	6.4 U	6.4 U	6.4 U	10.1	100
IRON	NA	NA	609.0	NA	NA	27800.0	NA	8040.0	300
LEAD	1.6 UJ	2.4 U	5.0 U	4.1 U	1.6 UJ	1.6 U	1.6 U	1.6 UJ	10
MANGANESE	NA	NA	66.5	NA	NA	944.0	NA	5000.0	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	100
SODIUM	NA	NA	36500.0	NA	NA	2030000.0	NA	2320000.0	50000

Notes:

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J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
[shaded]: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
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TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-91A MW-91A 16 11/15/94	GW1-MW-91B MW-91B 16 11/15/94	GW1-MW-92B MW-92B 16 11/14/94	GW1-MW-93A MW-93A 16 11/15/94	GW1-MW-93B MW-93B 16 11/15/94	GW1-MW-285B Dup of MW-93B 16 11/15/94	GW1-MW-94A MW-94A/O 06 11/17/94	GW1-MW-95A MW-95A/O 06 11/17/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	NA	NA	NA	NA	NA	NA	NA	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11 U	28.8	11.0 U	20
ARSENIC	11.2 J-	9.5 J-	6.0 J	8.5 UJ	8.5 UJ	9.5 J-	11.4	3.4	8
CADMIUM	1.3	1.8	1.0 U	1.0 U	1.0 U	2 U	1.1	2.0 U	4
CHROMIUM	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	11.4	100
IRON	NA	NA	NA	NA	NA	NA	NA	NA	300
LEAD	1.6 UJ	1.6 UJ	1.6 U	1.6 UJ	1.6 UJ	1.6 UJ	2.6 U	6.6 U	10
MANGANESE	NA	NA	NA	NA	NA	NA	NA	NA	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	100
SODIUM	NA	NA	NA	NA	NA	NA	NA	NA	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
[shaded] : The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-96A MW-96A 06 11/17/94	GW1-MW-96C MW-96C 06 11/17/94	GW1-MW-97A MW-97A 06A 11/16/94	GW1-MW-97B MW-97B 06B 11/17/94	GW1-MW-207B Dup of MW-97B 06B 11/17/94	GW1-MW-98A MW-98A 06B 11/16/94	GW1-MW-98B MW-98B 06B 11/16/94	GW1-MW-99A MW-99A 06B 11/16/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	1370.0 J	NA	4760.0	1290.0 J	934 J	NA	NA	573.0	200
ANTIMONY	11.0 U	11.0 U	11.0 U	17.6 U	39.2	11.0 U	11.0 U	11.0 U	20
ARSENIC	6.2	8.5 U	10.6 J-	8.5 U	8.5 U	14.8 J-	4.3 J-	28.8 J-	8
CADMIUM	2.0 U	1.0	1.0 U	1.0 U	1 U	1.0 U	1.0 U	1.0 U	4
CHROMIUM	7.0	17.4	22.2	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	100
IRON	8180.0	NA	26300.0	25900.0	26200	NA	NA	11400.0	300
LEAD	2.6 U	4.5 U	1.6 UJ	2.4 U	1.6 UJ	2.2 U	1.6 UJ	1.6 UJ	10
MANGANESE	411.0	NA	465.0	644.0	611	NA	NA	265.0	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	31.3	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	100
SODIUM	1830000.0	NA	3400000.0	3800000.0	3810000	NA	NA	1440000.0	50000

Notes:

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J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
[shaded]: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-99B MW-99B 06B 11/16/94	GW1-MW-100A MW-100A 11 11/14/94	GW1-MW-101A MW-101A 11 11/14/94	GW1-MW-103A MW-103A BKG 11/17/94	GW1-MW-103C MW-103C BKG 11/18/94	GW1-MW-104A MW-104A BKG 11/17/94	GW1-MW-104C MW-104C BKG 11/17/94	GW1-MW-105A MW-105A BKG 11/9/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	76900.0	NA	NA	33.9	NA	NA	NA	200
ANTIMONY	11.0 U	17.6 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	8.5 UJ	26.5 J	17.0 J	1.7 U	3.1	1.7 U	5.2	1.7 U	8
CADMIUM	1.0 U	1.5	1.0 U	2.0 U	1.0 U	1.0 U	1.0 U	1.0 U	4
CHROMIUM	6.4 U	271.0 J	6.4 U	6.4 U	6.4 U	6.4 U	13.1	11.7	100
IRON	NA	159000.0	NA	NA	824.0	NA	NA	NA	300
LEAD	1.6 UJ	239.0	1.6 U	1.6 UJ	2.7 U	2.6 U	5.1 U	4.0 U	10
MANGANESE	NA	2270.0	NA	NA	55.0	NA	NA	NA	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	164.0	12.8 U	15.8	12.8 U	14.8	16.7	14.9	100
SODIUM	NA	767000.0	NA	NA	42400.0	NA	NA	NA	50000

Notes:

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J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
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TABLE 5-5
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW1-MW-105C MW-105C BKG 11/9/94	GW1-MW-EPA2A MW-EPA2A 18A 11/10/94	GW1-MW-SA4 MW-SA4 151 11/8/94	GW1-MW-SA5 MW-SA5 151 11/10/94	GW1-MW-SPCI-4 MW-SPCI4 151 11/8/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	NA	NA	197.0 U	NA	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	1.7 U	1.7 U	1.7 U	1.7 U	1.7 U	8
CADMIUM	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	4
CHROMIUM	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	100
IRON	NA	NA	NA	20500.0	NA	300
LEAD	2.6 U	1.6 U	3.2	2.3 U	1.6 U	10
MANGANESE	NA	NA	NA	100.0	NA	50
MERCURY	0.2 U	0.2 U	0.2 UJ	0.2 U	0.2 UJ	2
NICKEL	12.8 U	12.8 U	12.8 U	12.8 U	19.8	100
SODIUM	NA	NA	NA	34200.0	NA	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
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TABLE 5-6
ANALYTICAL GROUNDWATER PESTICIDE RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	WELL ID	AREA*	DATE COLLECTED	ALDRIN** (ug/l)	NJDEP GROUNDWATER QUALITY STANDARD (ug/l)
GW1-MW-6	MW-6	19	11/11/94	0.0540 U	0.040
GW1-MW-6C	MW-6C	09	11/11/94	0.0520 U	0.040
GW1-MW-7	MW-7	01	11/11/94	0.0580 U	0.040
GW1-MW-8	MW-8	01	11/11/94	0.0510 U	0.040
GW1-MW-9	MW-9	01	11/11/94	0.0590 U	0.040
GW1-MW-10	MW-10	20	11/10/94	0.0560 U	0.040
GW1-MW-11	MW-11	07	11/8/94	0.0500 U	0.040
GW1-MW-12	MW-12	07	11/10/94	0.0520 U	0.040
GW1-MW-13	MW-13	02	11/9/94	0.0560 U	0.040
GW1-MW-14	MW-14	03	11/11/94	0.0500 U	0.040
GW1-MW-15	MW-15	03	11/10/94	0.0510 U	0.040
GW1-MW-16	MW-16	06A	11/16/94	0.0520 U	0.040
GW1-MW-17	MW-17	04	11/15/94	0.0520 U	0.040
GW1-MW-18	MW-18	04	11/10/94	0.0560 U	0.040
GW1-MW-19	MW-19	04	11/11/94	0.0510 U	0.040
GW1-MW-20	MW-20	05	11/16/94	0.0520 U	0.040
GW1-MW-21	MW-21	05	11/17/94	0.0540 U	0.040
GW1-MW-22	MW-22	05	11/16/94	0.0540 U	0.040
GW1-MW-25	MW-25	06A	11/15/94	0.0540 U	0.040
GW1-MW-26	MW-26	06A	11/16/94	0.0540 U	0.040
GW1-MW-27	MW-27	06A	11/16/94	0.0520 U	0.040
GW1-MW-28	MW-28	11	11/15/94	0.0500 U	0.040
GW1-MW-28B	MW-28B	11	11/15/94	0.0510 U	0.040
GW1-MW-29	MW-29	11	11/15/94	0.0520 U	0.040
GW1-MW-30	MW-30	11	11/15/94	0.0520 U	0.040
GW1-MW-31	MW-31	01	11/11/94	0.0540 U	0.040
GW1-MW-34	MW-34	06B	11/16/94	0.0520 U	0.040
GW1-MW-42A	MW-42A	04	11/14/94	0.0520 U	0.040
GW1-MW-43	MW-43	04	11/11/94	0.0550 U	0.040
GW1-MW-44	MW-44	06A	11/15/94	0.0530 U	0.040
GW1-MW-45	MW-45	14	11/16/94	0.0560 U	0.040
GW1-MW-46A	MW-46A	10	11/9/94	0.0600 U	0.040
GW1-MW-47A	MW-47A	09	11/9/94	0.0520 U	0.040
GW1-MW-47C	MW-47C	09	11/10/94	0.0520 U	0.040
GW1-MW-48A	MW-48A	09	11/11/94	0.0510 U	0.040
GW1-MW-48B	MW-48B	09	11/11/94	0.0560 U	0.040
GW1-MW-49	MW-49	19	11/9/94	0.0520 U	0.040
GW1-MW-49C	MW-49C	19	11/9/94	0.0540 U	0.040
GW1-MW-201C	Dup. of MW-49C	19	11/9/94	0.0540 U	0.040
GW1-MW-50	MW-50	14	11/15/94	0.0550 U	0.040
GW1-MW-50B	MW-50B	14	11/15/94	0.0510 U	0.040
GW1-MW-50C	MW-50C	14	11/15/94	0.0510 U	0.040
GW1-MW-51	MW-51	16	11/14/94	0.0540 U	0.040
GW1-MW-52A	MW-52A	16	11/15/94	0.0500 U	0.040
GW1-MW-52B	MW-52B	16	11/15/94	0.0560 U	0.040
GW1-MW-53	MW-53	16	11/18/94	0.0590 U	0.040
GW1-MW-54	MW-54	19	11/14/94	0.0560 U	0.040
GW1-MW-56	MW-56	10	11/9/94	0.0580 U	0.040
GW1-MW-57	MW-57	10	11/9/94	0.0540 U	0.040
GW1-MW-58	MW-58	03	11/8/94	0.0550 U	0.040
GW1-MW-59	MW-59	07	11/10/94	0.0550 U	0.040
GW1-MW-59C	MW-59C	07	11/10/94	0.0510 U	0.040
GW1-MW-202	Dup. of MW-59C	07	11/10/94	0.0500 U	0.040
GW1-MW-60	MW-60	14	11/14/94	0.0540 U	0.040
GW1-MW-60B	MW-60B	14	11/14/94	0.0520 U	0.040
GW1-MW-60C	MW-60C	14	11/18/94	0.0520 U	0.040
GW1-MW-61	MW-61	04	11/17/94	0.0520 U	0.040
GW1-MW-62	MW-62	06	11/11/94	0.0520 U	0.040

Notes: See Page 3 of 3.

TABLE 5-6
ANALYTICAL GROUNDWATER PESTICIDE RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	WELL ID	AREA*	DATE COLLECTED	ALDRIN** (ug/l)	NJDEP GROUNDWATER QUALITY STANDARD (ug/l)
GW1-MW-63	MW-63	12	11/15/94	0.0520 U	0.040
GW1-MW-63A	MW-63A	14	11/15/94	0.0580 U	0.040
GW1-MW-65	MW-65	05	11/16/94	0.0540 U	0.040
GW1-MW-66	MW-66	05	11/16/94	0.0520 U	0.040
GW1-MW-67	MW-67	05	11/16/94	0.0510 U	0.040
GW1-MW-69A	MW-69A	XHW	11/9/94	0.0520 U	0.040
GW1-MW-70A	MW-70A	10	11/9/94	0.0530 U	0.040
GW1-MW-71C	MW-71C	18A	11/10/94	0.0500 U	0.040
GW1-MW-75A	MW-75A	04	11/11/94	0.0540 U	0.040
GW1-MW-75C	MW-75C	04	11/11/94	0.0530 U	0.040
GW1-MW-76A	MW-76A	04	11/10/94	0.0540 U	0.040
GW1-MW-76B	MW-76B	04	11/11/94	0.0530 U	0.040
GW1-MW-76C	MW-76C	04	11/10/94	0.0520 U	0.040
GW1-MW-77A	MW-77A	14	11/8/94	0.0540 U	0.040
GW1-MW-77B	MW-77B	14	11/8/94	0.0500 U	0.040
GW1-MW-78A	MW-78A	14	11/8/94	0.0520 U	0.040
GW1-MW-79B	MW-79B	08	11/14/94	0.0500 U	0.040
GW1-MW-79C	MW-79C	08	11/14/94	0.0530 U	0.040
GW1-MW-80A	MW-80A	09	11/14/94	0.0500 U	0.040
GW1-MW-203A	Dup. of MW-80A	09	11/14/94	0.0510 U	0.040
GW1-MW-81A	MW-81A	151	11/8/94	0.0540 U	0.040
GW1-MW-82A	MW-82A	OI	11/8/94	0.0520 U	0.040
GW1-MW-83A	MW-83A	15	11/8/94	0.0500 U	0.040
GW1-MW-84A	MW-84A	15	11/8/94	0.0500 U	0.040
GW1-MW-85A	MW-85A	15	11/8/94	0.0540 U	0.040
GW1-MW-200A	Dup. of MW-85A	15	11/8/94	0.0520 U	0.040
GW1-MW-86A	MW-86A	15	11/8/94	0.0540 U	0.040
GW1-MW-86C	MW-86C	15	11/8/94	0.0500 U	0.040
GW1-MW-87A	MW-87A	18D	11/9/94	0.0520 U	0.040
GW1-MW-87C	MW-87C	18D	11/9/94	0.0520 U	0.040
GW1-MW-88A	MW-88A	18C	11/10/94	0.0540 U	0.040
GW1-MW-88C	MW-88C	18C	11/10/94	0.0520 U	0.040
GW1-MW-89A	MW-89A	01	11/18/94	0.0520 U	0.040
GW1-MW-89C	MW-89C	01	11/17/94	0.0540 U	0.040
GW1-MW-90A	MW-90A	16	11/14/94	0.0580 U	0.040
GW1-MW-90B	MW-90B	16	11/14/94	0.0530 U	0.040
GW1-MW-90C	MW-90C	16	11/18/94	0.0550 U	0.040
GW1-MW-91A	MW-91A	16	11/15/94	0.0500 U	0.040
GW1-MW-91B	MW-91B	16	11/15/94	0.0520 U	0.040
GW1-MW-92B	MW-92B	16	11/14/94	0.0520 U	0.040
GW1-MW-93A	MW-93A	16	11/15/94	0.0540 U	0.040
GW1-MW-93B	MW-93B	16	11/15/94	0.0510 U	0.040
GW1-MW-205B	Dup. of MW-93B	16	11/15/94	0.0520 U	0.040
GW1-MW-94A	MW-94A	06	11/17/94	0.0520 U	0.040
GW1-MW-95A	MW-95A	06	11/17/94	0.0550 U	0.040
GW1-MW-96A	MW-96A	06	11/17/94	0.0530 U	0.040
GW1-MW-96C	MW-96C	06	11/17/94	0.0520 U	0.040
GW1-MW-97A	MW-97A	06A	11/16/94	0.0510 U	0.040
GW1-MW-97B	MW-97B	06B	11/17/94	0.0520 U	0.040
GW1-MW-207B	Dup. of MW-97B	06B	11/17/94	0.0520 U	0.040
GW1-MW-98A	MW-98A	06B	11/16/94	0.0520 U	0.040
GW1-MW-98B	MW-98B	06B	11/16/94	0.0560 U	0.040
GW1-MW-99A	MW-99A	06B	11/16/94	0.0520 U	0.040
GW1-MW-99B	MW-99B	06B	11/16/94	0.0530 U	0.040
GW1-MW-100A	MW-100A	11	11/14/94	0.0420 J	0.040
GW1-MW-101A	MW-101A	11	11/14/94	0.0520 U	0.040
GW1-MW-103A	MW-103A	BKG	11/17/94	0.0520 U	0.040
GW1-MW-103C	MW-103C	BKG	11/18/94	0.0680 U	0.040
GW1-MW-104A	MW-104A	BKG	11/17/94	0.0500 U	0.040

Notes: See Page 3 of 3.

TABLE 5-6
ANALYTICAL GROUNDWATER PESTICIDE RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	WELL ID	AREA*	DATE COLLECTED	ALDRIN** (ug/l)	NJDEP GROUNDWATER QUALITY STANDARD (ug/l)
GW1-MW-104C	MW-104C	BKG	11/17/94	0.0560 U	0.040
GW1-MW-105A	MW-105A	BKG	11/9/94	0.0520 U	0.040
GW1-MW-105C	MW-105C	BKG	11/9/94	0.0520 U	0.040
GW1-MW-EPA2A	MW-EPA2A	18A	11/10/94	0.0520 U	0.040
GW1-MW-SA4	MW-SA4	151	11/8/94	0.0510 U	0.040
GW1-MW-SA5	MW-SA5	151	11/10/94	0.0510 U	0.040
GW1-MW-SPCI-4	MW-SPCI4	151	11/8/94	0.0520 U	0.040

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".
**: As shown in the table, the detection limit for aldrin is greater than the NJDEP Groundwater Quality Standard. However, the detection limit indicated meets the approved PQL in the CDAP of 0.05 ug/l.

TABLE 5-7
ANALYTICAL GROUNDWATER TOTAL DISSOLVED SOLID RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 1
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	WELL ID	AREA*	DATE COLLECTED	TOTAL DISSOLVED SOLIDS (mg/l)	NJDEP GROUNDWATER QUALITY STANDARD (mg/l)
GW1-MW-6	MW-6	19	11/11/94	240	500
GW1-MW-11	MW-11	07	11/8/94	800	500
GW1-MW-14	MW-14	03	11/11/94	640	500
GW1-MW-26	MW-26	06A	11/16/94	620	500
GW1-MW-28B	MW-28B	11	11/15/94	19000	500
GW1-MW-31	MW-31	01	11/11/94	130	500
GW1-MW-42A	MW-42A	04	11/14/94	230	500
GW1-MW-49C	MW-49C	19	11/9/94	270	500
GW1-MW-50C	MW-50C	14	11/15/94	12000	500
GW1-MW-56	MW-56	10	11/9/94	210	500
GW1-MW-60	MW-60	14	11/14/94	12000	500
GW1-MW-60B	MW-60B	14	11/14/94	14000	500
GW1-MW-61	MW-61	04	11/17/94	490	500
GW1-MW-66	MW-66	05	11/16/94	350	500
GW1-MW-79B	MW-79B	08	11/14/94	420	500
GW1-MW-82A	MW-82A	OI	11/8/94	78	500
GW1-MW-86C	MW-86C	15	11/8/94	190	500
GW1-MW-87A	MW-87A	18D	11/9/94	100	500
GW1-MW-90A	MW-90A	16	11/14/94	6200	500
GW1-MW-90C	MW-90C	16	11/18/94	19000 J	500
GW1-MW-96C	MW-96C	06	11/17/94	15000	500
GW1-MW-97A	MW-97A	06A	11/16/94	13000	500
GW1-MW-98B	MW-98B	06B	11/16/94	1400	500
GW1-MW-103C	MW-103C	BKG	11/18/94	280	500
GW1-MW-104A	MW-104A	BKG	11/17/94	130	500
GW1-MW-EPA2A	MW-EPA2A	18A	11/10/94	98	500

Notes:

J: Indicates an estimated value.
U: The compound was not detected at the detection limit concentration indicated.
mg/l: All results are in milligrams per liter or parts per million unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-8
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-6C MW-6C 09 12/15/94	GW2-MW-28B MW-28B 11 12/14/94	GW2-MW-40 MW-40 BKG 12/12/94	GW2-MW-47C MW-47C 09 12/13/94	GW2-MW-49C MW-49C 19 12/14/94	GW2-MW-50B MW-50B 14 12/13/94	GW2-MW-50C MW-50C 14 12/13/94	GW2-MW-69C MW-69C 07 12/13/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	3.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	11.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	8.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-8
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-60B MW-60B 14 12/15/94	GW2-MW-60C MW-60C 14 12/15/94	GW2-MW-63A MW-63A 14 12/14/94	GW2-MW-65 MW-65 05 12/15/94	GW2-MW-66 MW-66 05 12/15/94	GW2-MW-67 MW-67 05 12/15/94	GW2-MW-69A MW-69A XHW 12/15/94	GW2-MW-70A MW-70A 10 12/14/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-8
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-71C MW-71C 18A 12/12/94	GW2-MW-75A MW-75A 04 12/13/94	GW2-MW-75C MW-75C 04 12/13/94	GW2-MW-76A MW-76A 04 12/13/94	GW2-MW-76B MW-76B 04 12/13/94	GW2-MW-76C MW-76C 04 12/13/94	GW2-MW-77A MW-77A 14 12/13/94	GW2-MW-77B MW-77B 14 12/13/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-8
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-78A MW-78A 14 12/13/94	GW2-MW-79B MW-79B 08 12/14/94	GW2-MW-79C MW-79C 08 12/14/94	GW2-MW-80A MW-80A 09 12/14/94	GW2-MW-82A MW-82A 01 12/12/94	GW2-MW-83A MW-83A 15 12/13/94	GW2-MW-84A MW-84A 15 12/12/94	GW2-MW-85A MW-85A 15 12/12/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	22.00	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	12.00	1.00 U	1.00 U	8.00	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-8
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-86A MW-86A 15 12/13/94	GW2-MW-86C MW-86C 15 12/13/94	GW2-MW-87A MW-87A 18D 12/12/94	GW2-MW-87C MW-87C 18D 12/12/94	GW2-MW-88A MW-88A 18C 12/12/94	GW2-MW-88C MW-88C 18C 12/12/94	GW2-MW-89A MW-89A 01 12/15/94	GW2-MW-89C MW-89C 01 12/15/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	2.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	1.00 U	10.00	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	5.00	1.00 U	3.00	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
[shaded] : The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-8
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-90A MW-90A 16 12/15/94	GW2-MW-90B MW-90B 16 12/15/94	GW2-MW-90C MW-90C 16 12/16/94	GW2-MW-91A MW-91A 16 12/15/94	GW2-MW-91B MW-91B 16 12/15/94	GW2-MW-92B MW-92B 16 12/15/94	GW2-MW-93A MW-93A 16 12/15/94	GW2-MW-93B MW-93B 16 12/15/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	2.00	1.00 U	19.00	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	32.00	1.00 U	1.00 U	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
[shaded] : The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-8
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-94A MW-94A/O 06 12/16/94	GW2-MW-95A MW-95A/O 06 12/16/94	GW2-MW-96A MW-96A 06 12/14/94	GW2-MW-96C MW-96C 06 12/14/94	GW2-MW-97A MW-97A 06A 12/16/94	GW2-MW-97B MW-97B 06B 12/16/94	GW2-MW-98A MW-98A 06B 12/13/94	GW2-MW-98B MW-98B 06B 12/13/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	2.00	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	1
									5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-8
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-99A MW-99A 06B 12/14/94	GW2-MW-208A Dup of MW-99A 06B 12/14/94	GW2-MW-99B MW-99B 06B 12/14/94	GW2-MW-100A MW-100A 11 12/14/94	GW2-MW-101A MW-101A 11 12/14/94	GW2-MW-209A Dup of MW-101A 11 12/14/94	GW2-MW-103A MW-103A BKG 12/12/94	GW2-MW-103C MW-103C BKG 12/13/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	8.00	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	48.00	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	8.00	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-8
ANALYTICAL GROUNDWATER VOC RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-104A MW-104A BKG 12/12/94	GW2-MW-104C MW-104C BKG 12/12/94	GW2-MW-105A MW-105A BKG 12/12/94	GW2-MW-105C MW-105C BKG 12/12/94	GW2-MW-210C Dup of MW-105C BKG 12/12/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
1,2-DICHLOROETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	2
BENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
CHLOROBENZENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	50
DICHLOROBROMOMETHANE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TETRACHLOROETHYLENE(PCE)	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	1
TOTAL-1,2-DICHLOROETHENE	1.00 U	1.00 U	1.00 U	1.00 U	1.00 U	10
TRICHLOROETHYLENE (TCE)	1.00 U	1.00 U	3.00	1.00 U	1.00 U	1
VINYL CHLORIDE	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
(shaded): The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-9
ANALYTICAL GROUNDWATER SVOC RESULTS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	WELL ID	AREA*	DATE COLLECTED	BIS(2-ETHYLHEXYL) PHTHALATE (ug/l)	NJDEP GROUNDWATER QUALITY STANDARD (ug/l)
GW2-MW-8C	MW-8C	09	12/15/94	11 U	30
GW2-MW-28B	MW-28B	11	12/14/94	11 U	30
GW2-MW-40	MW-40	BKG	12/12/94	10 U	30
GW2-MW-47C	MW-47C	09	12/13/94	11 U	30
GW2-MW-49C	MW-49C	19	12/14/94	11 U	30
GW2-MW-50B	MW-50B	14	12/13/94	10 U	30
GW2-MW-50C	MW-50C	14	12/13/94	11 U	30
GW2-MW-59C	MW-59C	07	12/13/94	11 U	30
GW2-MW-60B	MW-60B	14	12/15/94	11 U	30
GW2-MW-60C	MW-60C	14	12/15/94	11 U	30
GW2-MW-63A	MW-63A	14	12/14/94	10 U	30
GW2-MW-65	MW-65	05	12/15/94	11 U	30
GW2-MW-66	MW-66	05	12/15/94	10 U	30
GW2-MW-67	MW-67	05	12/15/94	11 U	30
GW2-MW-69A	MW-69A	XHW	12/15/94	11 U	30
GW2-MW-70A	MW-70A	10	12/14/94	11 U	30
GW2-MW-71C	MW-71C	18A	12/12/94	11 U	30
GW2-MW-75A	MW-75A	04	12/13/94	10 U	30
GW2-MW-75C	MW-75C	04	12/13/94	11 U	30
GW2-MW-76A	MW-76A	04	12/13/94	10 U	30
GW2-MW-76B	MW-76B	04	12/13/94	10 U	30
GW2-MW-76C	MW-76C	04	12/13/94	10 U	30
GW2-MW-77A	MW-77A	14	12/13/94	11 U	30
GW2-MW-77B	MW-77B	14	12/13/94	10 U	30
GW2-MW-78A	MW-78A	14	12/13/94	11 U	30
GW2-MW-79B	MW-79B	08	12/14/94	11 U	30
GW2-MW-79C	MW-79C	08	12/14/94	11 U	30
GW2-MW-80A	MW-80A	09	12/14/94	11 U	30
GW2-MW-82A	MW-82A	OI	12/12/94	10 U	30
GW2-MW-83A	MW-83A	15	12/13/94	11 U	30
GW2-MW-84A	MW-84A	15	12/12/94	10 U	30
GW2-MW-85A	MW-85A	15	12/12/94	10 U	30
GW2-MW-86A	MW-86A	15	12/13/94	11 U	30
GW2-MW-86C	MW-86C	15	12/13/94	11 U	30
GW2-MW-87A	MW-87A	18D	12/12/94	10 U	30
GW2-MW-87C	MW-87C	18D	12/12/94	10 U	30
GW2-MW-88A	MW-88A	18C	12/12/94	10 U	30
GW2-MW-88C	MW-88C	18C	12/12/94	11 U	30
GW2-MW-89A	MW-89A	01	12/15/94	13 U	30
GW2-MW-89C	MW-89C	01	12/15/94	11 U	30
GW2-MW-90A	MW-90A	16	12/15/94	11 U	30
GW2-MW-90B	MW-90B	16	12/15/94	10 U	30
GW2-MW-90C	MW-90C	16	12/16/94	11 U	30
GW2-MW-91A	MW-91A	16	12/15/94	11 U	30
GW2-MW-91B	MW-91B	16	12/15/94	11 U	30
GW2-MW-92B	MW-92B	16	12/15/94	12 U	30
GW2-MW-93A	MW-93A	16	12/15/94	10 U	30
GW2-MW-93B	MW-93B	16	12/15/94	11 U	30
GW2-MW-94A	MW-94A/O	06	12/16/94	11 U	30
GW2-MW-95A	MW-95A/O	06	12/16/94	10 U	30
GW2-MW-96A	MW-96A	06	12/14/94	11 U	30
GW2-MW-96C	MW-96C	06	12/14/94	11 U	30
GW2-MW-97A	MW-97A	06A	12/16/94	10 U	30
GW2-MW-97B	MW-97B	06B	12/16/94	10 U	30

Notes: See Page 2 of 2.

TABLE 5-9
ANALYTICAL GROUNDWATER SVOC RESULTS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	WELL ID	AREA*	DATE COLLECTED	BIS(2-ETHYLHEXYL) PHTHALATE (ug/l)	NJDEP GROUNDWATER QUALITY STANDARD (ug/l)
GW2-MW-98A	MW-98A	06B	12/13/94	10 U	30
GW2-MW-98B	MW-98B	06B	12/13/94	10 U	30
GW2-MW-99A	MW-99A	06B	12/14/94	11 U	30
GW2-MW-208A	Dup. of MW-99A	06B	12/14/94	11 U	30
GW2-MW-99B	MW-99B	06B	12/14/94	10 U	30
GW2-MW-100A	MW-100A	11	12/14/94	13 U	30
GW2-MW-101A	MW-101A	11	12/14/94	11 U	30
GW2-MW-209A	Dup. of MW-101A	11	12/14/94	11 U	30
GW2-MW-103A	MW-103A	BKG	12/12/94	11 U	30
GW2-MW-103C	MW-103C	BKG	12/13/94	10 U	30
GW2-MW-104A	MW-104A	BKG	12/12/94	11 U	30
GW2-MW-104C	MW-104C	BKG	12/12/94	2 J	30
GW2-MW-105A	MW-105A	BKG	12/12/94	1 J	30
GW2-MW-105C	MW-105C	BKG	12/12/94	1 J	30
GW2-MW-210C	Dup. of MW-105C	BKG	12/12/94	10 U	30

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-10
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-6C MW-6C 09 12/15/94	GW2-MW-28B MW-28B 11 12/14/94	GW2-MW-40 MW-40 BKG 12/12/94	GW2-MW-47C MW-47C 09 12/13/94	GW2-MW-49C MW-49C 19 12/14/94	GW2-MW-50B MW-50B 14 12/13/94	GW2-MW-56C MW-56C 14 12/13/94	GW2-MW-69C MW-69C 07 12/13/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	NA	30.4	79.2 U	NA	NA	NA	48.6 U	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	1.7 UJ	19.0 U	1.7 U	2.2	1.9 U	3.4	1.7 U	1.7 U	8
CADMIUM	2.0 UJ	2.0 U	2.0 U	1.0 U	2.0 U	1.0 U	1.0 U	1.0 U	4
CHROMIUM	21.4	6.4 U	6.4 U	6.4 U	6.4 U	7.8 U	6.4 U	6.4 U	100
IRON	NA	NA	45.3 U	5960.0	NA	NA	NA	423.0 U	300
LEAD	1.7 U	4.4 J	2.3	1.6 U	1.6 U	1.9 U	3.0 U	1.9 U	10
MANGANESE	NA	NA	119.0	251.0	NA	NA	NA	53.8 U	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	13.1	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	100
SODIUM	NA	NA	38800.0 J+	17800.0	NA	NA	NA	26800.0	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-10
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-60B MW-60B 14 12/15/94	GW2-MW-60C MW-60C 14 12/15/94	GW2-MW-63A MW-63A 14 12/14/94	GW2-MW-65 MW-65 05 12/15/94	GW2-MW-66 MW-66 05 12/15/94	GW2-MW-67 MW-67 05 12/15/94	GW2-MW-68A MW-68A 118 12/14/94	GW2-MW-69A MW-69A XHW 12/15/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	123.0 U	NA	NA	389.0	NA	NA	NA	200
ANTIMONY	17.6 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	5.4 J-	3.8 J-	1.9 U	1.7 UJ	1.7 UJ	3.6 J-	1.9 U	2.2 J-	8
CADMIUM	2.2 J-	2.0 U	2.0 U	2.0 J-	4.3 J+	5.0 J-	2.0 U	2.0 UJ	4
CHROMIUM	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	11.4	20.9	8.1	100
IRON	NA	6600.0	NA	NA	106.0	NA	NA	NA	300
LEAD	3.2 UJ	1.6 U	3.1 J	1.6 UJ	1.6 U	3.8 U	1.6 U	2.3 U	10
MANGANESE	NA	269.0	NA	NA	1460.0	NA	NA	NA	50
MERCURY	0.2 U	0.5	0.2 U	0.3	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	12.8 U	12.8 U	36.6	75.0	33.4	30.7	12.8 U	100
SODIUM	NA	3820000.0	NA	NA	46700.0	NA	NA	NA	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-10
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-70A MW-70A 10 12/14/94	GW2-MW-71C MW-71C 18A 12/12/94	GW2-MW-75A MW-75A 04 12/13/94	GW2-MW-75C MW-75C 04 12/13/94	GW2-MW-76A MW-76A 04 12/13/94	GW2-MW-76B MW-76B 04 12/13/94	GW2-MW-76C MW-76C 04 12/13/94	GW2-MW-77A MW-77A 14 12/13/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	29.9	NA	NA	6010.0	NA	NA	288.0 U	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	17.6 U	20
ARSENIC	1.9 U	1.7 U	1.7 U	2.1	5.2	11.1	2.4	5.6	8
CADMIUM	2.0 U	2.0 U	1.2	2.0 U	1.0 U	1.0 U	2.0 U	1.0 U	4
CHROMIUM	6.4 U	6.4 U	11.5 U	6.4 U	35.3 U	6.4 U	25.4 U	6.4 U	100
IRON	NA	1670.0	NA	NA	28900.0	NA	NA	24700.0	300
LEAD	1.6 U	1.6 U	2.3 U	1.6 U	18.6 R	7.9 U	17.4 R	2.6 U	10
MANGANESE	NA	91.7	NA	NA	741.0	NA	NA	1270.0	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.4	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	12.8 U	34.2 U	12.8 U	18.5 U	12.8 U	16.3 U	12.8 U	100
SODIUM	NA	1840000.0 J+	NA	NA	144000.0	NA	NA	197000.0	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-10
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-77B MW-77B 14 12/13/94	GW2-MW-78A MW-78A 14 12/13/94	GW2-MW-79B MW-79B 08 12/14/94	GW2-MW-79C MW-79C 08 12/14/94	GW2-MW-80A MW-80A 09 12/14/94	GW2-MW-82A MW-82A 01 12/12/94	GW2-MW-83A MW-83A 15 12/13/94	GW2-MW-84A MW-84A 15 12/12/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	NA	NA	7650.0 J	NA	1510.0	NA	NA	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	2.9	2.4	1.9	1.9 U	1.9 U	1.7 U	1.7 U	1.7 U	8
CADMIUM	1.0 U	2.1	2.0 U	2.0 U	2.1	2.0 U	1.0 U	2.0 U	4
CHROMIUM	10.7 U	6.4 U	6.4 U	15.2	7.3	11.2	6.4 U	6.4 U	100
IRON	NA	NA	NA	13500.0	NA	4010.0	NA	NA	300
LEAD	5.0 U	5.2 U	3.5 J	4.2	3.3 J	2.4	1.6 U	2.6	10
MANGANESE	NA	NA	NA	1970.0	NA	127.0	NA	NA	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	26.0 U	12.8 U	12.8 U	14.4	12.8 U	51.9 U	15.1	100
SODIUM	NA	NA	NA	123000.0	NA	2690.0 J+	NA	NA	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-10
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-85A MW-85A 15 12/12/94	GW2-MW-86A MW-86A 15 12/13/94	GW2-MW-86C MW-86C 15 12/13/94	GW2-MW-87A MW-87A 01 12/12/94	GW2-MW-87C MW-87C 18D 12/12/94	GW2-MW-88A MW-88A 18D 12/12/94	GW2-MW-88C MW-88C 18C 12/12/94	GW2-MW-89A MW-89A 18C 12/15/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	NA	99.7 U	NA	NA	NA	120.0	NA	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	2.0	1.7 U	1.7 U	1.7 U	1.7 U	1.8	1.7 U	4.1 J-	8
CADMIUM	1.0 U	1.0 U	1.0 U	2.0 U	2.0 U	1.0 U	2.0 U	3.0 J-	4
CHROMIUM	6.4 U	6.4 U	6.4 U	6.4 U	6.4 U	7.3	6.4 U	40.1	100
IRON	NA	NA	1470.0 R	NA	NA	NA	500.0	NA	300
LEAD	1.6 U	2.4 U	5.8 R	1.6	1.6 U	3.4	1.6 U	9.3 U	10
MANGANESE	NA	NA	68.6 R	NA	NA	NA	54.9	NA	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	51.2	75.8 R	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	30.1	100
SODIUM	NA	NA	21500.0	NA	NA	NA	37800.0 J+	NA	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-10
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-89C MW-89C 01 12/15/94	GW2-MW-90A MW-90A 16 12/15/94	GW2-MW-90B MW-90B 16 12/15/94	GW2-MW-90C MW-90C 16 12/16/94	GW2-MW-91A MW-91A 16 12/15/94	GW2-MW-91B MW-91B 16 12/15/94	GW2-MW-92B MW-92B 16 12/15/94	GW2-MW-93A MW-93A 16 12/15/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	1730.0	NA	554.0	NA	NA	NA	NA	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	1.7 UJ	5.2 J-	1.7 UJ	8.5 U	12.3 J-	2.4 J-	3.9 J-	12.4 J-	8
CADMIUM	2.0 UJ	2.0 U	2.0 UJ	2.0 UJ	2.0 UJ	3.0 J-	2.0 UJ	2.0 UJ	4
CHROMIUM	6.4 U	6.4 U	6.4 U	12.8 U	6.4 U	6.4 U	11.2	6.4 U	100
IRON	NA	28500.0	NA	10500.0	NA	NA	NA	NA	300
LEAD	1.6 UJ	1.6 U	1.6 UJ	2.0 U	1.6 UJ	3.2 UJ	1.6 UJ	1.6 UJ	10
MANGANESE	NA	886.0	NA	5770.0	NA	NA	NA	NA	50
MERCURY	0.2 U	0.3	0.2 U	0.2 U	0.2 U	0.2 U	0.3	0.2 U	2
NICKEL	12.8 U	12.8 U	12.8 U	25.6 U	12.8 U	12.8 U	12.8 U	12.8 U	100
SODIUM	NA	1840000.0	NA	2300000.0	NA	NA	NA	NA	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-10
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-93B MW-93B 16 12/15/94	GW2-MW-94A MW-94A/O 06 12/16/94	GW2-MW-95A MW-95A/O 06 12/16/94	GW2-MW-96A MW-96A 06 12/14/94	GW2-MW-96C MW-96C 06 12/14/94	GW2-MW-97A MW-97A 06A 12/16/94	GW2-MW-97B MW-97B 06B 12/16/94	GW2-MW-98A MW-98A 06B 12/13/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	NA	NA	648.0 J	NA	332.0	226.0	NA	200
ANTIMONY	11.0 U	17.6 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	8.5 UJ	15.5 J-	3.5 J-	6.5	1.9 U	22.5	8.5 U	15.2	8
CADMIUM	2.0 UJ	2.0 J-	2.0 J-	2.0 U	2.0 U	2.0 UJ	2.0 UJ	1.0 U	4
CHROMIUM	6.4 U	6.4 U	6.4 U	6.4 U	12.8 U	6.4 U	6.4 U	6.4 U	100
IRON	NA	NA	NA	5120.0	NA	15800.0	25900.0	NA	300
LEAD	3.2 UJ	3.2 UJ	5.9 U	1.6 U	1.6 U	1.6 UJ	3.2 UJ	2.0 U	10
MANGANESE	NA	NA	NA	412.0	NA	409.0	650.0	NA	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	12.8 U	12.8 U	172.0	25.6 U	12.8 U	12.8 U	12.8 U	100
SODIUM	NA	NA	NA	1890000.0	NA	3340000.0	3900000.0	NA	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
(shaded): The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-10
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-98B MW-98B 06B 12/13/94	GW2-MW-99A MW-99A 06B 12/14/94	GW2-MW-208A Dup of MW-99A 06B 12/14/94	GW2-MW-99B MW-99B 06B 12/14/94	GW2-MW-100A MW-100A 11 12/14/94	GW2-MW-101A MW-101A 11 12/14/94	GW2-MW-209A Dup of MW-101A 11 12/14/94	GW2-MW-103A MW-103A BKG 12/12/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	NA	365.0 J	525.0 J	NA	1530.0 J	NA	NA	NA	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	1.7 U	16.9	17.0	19.0 U	1.9 U	20.6	19.0 U	1.7 U	8
CADMIUM	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	4
CHROMIUM	6.4 U	6.4 U	6.4 U	6.4 U	13.6	6.4 U	6.4 U	6.4 U	100
IRON	NA	11100.0	11200.0	NA	11900.0	NA	NA	NA	300
LEAD	3.3 U	1.6 U	1.6 U	1.6 U	5.4	1.6 U	1.6 U	1.6 U	10
MANGANESE	NA	256.0	247.0	NA	1120.0	NA	NA	NA	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	12.8 U	100
SODIUM	NA	1580000.0	1540000.0	NA	288000.0	NA	NA	NA	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
[shaded]: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-10
ANALYTICAL GROUNDWATER METAL RESULTS EXCEEDING
NJDEP GROUNDWATER QUALITY STANDARDS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID: WELL ID: AREA*: DATE COLLECTED:	GW2-MW-103C MW-103C BKG 12/13/94	GW2-MW-104A MW-104A BKG 12/12/94	GW2-MW-104C MW-104C BKG 12/12/94	GW2-MW-105A MW-105A BKG 12/12/94	GW2-MW-105C MW-105C BKG 12/12/94	GW2-MW-210C Dup of MW-105C BKG 12/12/94	NJDEP GROUNDWATER QUALITY STANDARDS (ug/l)
ALUMINUM	226.0 U	NA	NA	NA	NA	NA	200
ANTIMONY	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	11.0 U	20
ARSENIC	2.4	1.7 U	3.2	1.7 U	1.8	1.7 U	8
CADMIUM	1.0 U	1.0 U	2.0 U	2.0 U	2.0 U	2.0 U	4
CHROMIUM	6.4 U	6.4 U	25.1	8.0	6.4 U	7.2	100
IRON	1300.0 U	NA	NA	NA	NA	NA	300
LEAD	4.0 U	1.6 U	2.9	5.7	1.6 U	1.9	10
MANGANESE	81.2	NA	NA	NA	NA	NA	50
MERCURY	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	2
NICKEL	12.8 U	12.8 U	21.3	15.4	12.8 U	12.8 U	100
SODIUM	40900.0	NA	NA	NA	NA	NA	50000

Notes:

NA: Not analyzed
J: Indicates an estimated value.
J-: Indicates an estimate value biased low.
J+: Indicates an estimate value biased high.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
UJ: The compound was not detected at the estimated detection limit concentration indicated.
[shaded]: The concentration of that compound exceeds the NJDEP Groundwater Quality Standard.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".

TABLE 5-11
ANALYTICAL GROUNDWATER PESTICIDE RESULTS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	WELL ID	AREA*	DATE COLLECTED	ALDRIN** (ug/l)	NJDEP GROUNDWATER QUALITY STANDARD (ug/l)
GW2-MW-6C	MW-6C	09	12/15/94	0.0520 U	0.040
GW2-MW-28B	MW-28B	11	12/14/94	0.0520 U	0.040
GW2-MW-40	MW-40	BKG	12/12/94	0.0500 U	0.040
GW2-MW-47C	MW-47C	09	12/13/94	0.0550 U	0.040
GW2-MW-49C	MW-49C	19	12/14/94	0.0510 U	0.040
GW2-MW-50B	MW-50B	14	12/13/94	0.0520 U	0.040
GW2-MW-50C	MW-50C	14	12/13/94	0.0600 U	0.040
GW2-MW-59C	MW-59C	07	12/13/94	0.0500 U	0.040
GW2-MW-60B	MW-60B	14	12/15/94	0.0580 U	0.040
GW2-MW-60C	MW-60C	14	12/15/94	0.0580 U	0.040
GW2-MW-63A	MW-63A	14	12/14/94	0.0500 U	0.040
GW2-MW-65	MW-65	05	12/15/94	0.0500 U	0.040
GW2-MW-66	MW-66	05	12/15/94	0.0510 U	0.040
GW2-MW-67	MW-67	05	12/15/94	0.0500 U	0.040
GW2-MW-69A	MW-69A	XHW	12/15/94	0.0530 U	0.040
GW2-MW-70A	MW-70A	10	12/14/94	0.0550 U	0.040
GW2-MW-71C	MW-71C	18A	12/12/94	0.0570 U	0.040
GW2-MW-75A	MW-75A	04	12/13/94	0.0520 U	0.040
GW2-MW-75C	MW-75C	04	12/13/94	0.0500 U	0.040
GW2-MW-76A	MW-76A	04	12/13/94	0.0560 U	0.040
GW2-MW-76B	MW-76B	04	12/13/94	0.0520 U	0.040
GW2-MW-76C	MW-76C	04	12/13/94	0.0500 U	0.040
GW2-MW-77A	MW-77A	14	12/13/94	0.0530 U	0.040
GW2-MW-77B	MW-77B	14	12/13/94	0.0560 U	0.040
GW2-MW-78A	MW-78A	14	12/13/94	0.0540 U	0.040
GW2-MW-79B	MW-79B	08	12/14/94	0.0550 U	0.040
GW2-MW-79C	MW-79C	08	12/14/94	0.0500 U	0.040
GW2-MW-80A	MW-80A	09	12/14/94	0.0520 U	0.040
GW2-MW-82A	MW-82A	OI	12/12/94	0.0500 U	0.040
GW2-MW-83A	MW-83A	15	12/13/94	0.0540 U	0.040
GW2-MW-84A	MW-84A	15	12/12/94	0.0500 U	0.040
GW2-MW-85A	MW-85A	15	12/12/94	0.0500 U	0.040
GW2-MW-86A	MW-86A	15	12/13/94	0.0520 U	0.040
GW2-MW-86C	MW-86C	15	12/13/94	0.0520 U	0.040
GW2-MW-87A	MW-87A	18D	12/12/94	0.0560 U	0.040
GW2-MW-87C	MW-87C	18D	12/12/94	0.0500 U	0.040
GW2-MW-88A	MW-88A	18C	12/12/94	0.0510 U	0.040
GW2-MW-88C	MW-88C	18C	12/12/94	0.0640 U	0.040
GW2-MW-89A	MW-89A	01	12/15/94	0.0770 U	0.040
GW2-MW-89C	MW-89C	01	12/15/94	0.0520 U	0.040
GW2-MW-90A	MW-90A	16	12/15/94	0.0500 U	0.040
GW2-MW-90B	MW-90B	16	12/15/94	0.0520 U	0.040
GW2-MW-90C	MW-90C	16	12/16/94	0.0520 U	0.040
GW2-MW-91A	MW-91A	16	12/15/94	0.0530 U	0.040
GW2-MW-91B	MW-91B	16	12/15/94	0.0560 U	0.040
GW2-MW-92B	MW-92B	16	12/15/94	0.0540 U	0.040
GW2-MW-93A	MW-93A	16	12/15/94	0.0500 U	0.040
GW2-MW-93B	MW-93B	16	12/15/94	0.0550 U	0.040
GW2-MW-94A	MW-94A/O	06	12/16/94	0.0510 U	0.040
GW2-MW-95A	MW-95A/O	06	12/16/94	0.0540 U	0.040
GW2-MW-96A	MW-96A	06	12/14/94	0.0520 U	0.040
GW2-MW-96C	MW-96C	06	12/14/94	0.0540 U	0.040
GW2-MW-97A	MW-97A	06A	12/16/94	0.0520 U	0.040
GW2-MW-97B	MW-97B	06B	12/16/94	0.0560 U	0.040

Notes: See Page 2 of 2.

TABLE 5-11
ANALYTICAL GROUNDWATER PESTICIDE RESULTS - ROUND 2
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SAMPLE ID	WELL ID	AREA*	DATE COLLECTED	ALDRIN** (ug/l)	NJDEP GROUNDWATER QUALITY STANDARD (ug/l)
GW2-MW-98A	MW-98A	06B	12/13/94	0.0580 U	0.040
GW2-MW-98B	MW-98B	06B	12/13/94	0.0510 U	0.040
GW2-MW-99A	MW-99A	06B	12/14/94	0.0540 U	0.040
GW2-MW-208A	Dup. of MW-99A	06B	12/14/94	0.0520 U	0.040
GW2-MW-99B	MW-99B	06B	12/14/94	0.0510 U	0.040
GW2-MW-100A	MW-100A	11	12/14/94	0.5800 U	0.040
GW2-MW-101A	MW-101A	11	12/14/94	0.0550 U	0.040
GW2-MW-209A	Dup. of MW-101A	11	12/14/94	0.0560 U	0.040
GW2-MW-103A	MW-103A	BKG	12/12/94	0.0530 U	0.040
GW2-MW-103C	MW-103C	BKG	12/13/94	0.0500 U	0.040
GW2-MW-104A	MW-104A	BKG	12/12/94	0.0540 U	0.040
GW2-MW-104C	MW-104C	BKG	12/12/94	0.0540 U	0.040
GW2-MW-105A	MW-105A	BKG	12/12/94	0.0500 U	0.040
GW2-MW-105C	MW-105C	BKG	12/12/94	0.0520 U	0.040
GW2-MW-210C	Dup. of MW-105C	BKG	12/12/94	0.0500 U	0.040

Notes:

J: Indicates an estimated value.
Dup.: QC duplicate sample of the well indicated.
U: The compound was not detected at the detection limit concentration indicated.
ug/l: All results are in micrograms per liter or parts per billion unless otherwise noted.
*: These area designations reflect only the physical location of construction. The analytical groundwater results from each well may be used to evaluate more than one "Area".
**: As shown in the table, the detection limit for aldrin is greater than the NJDEP Groundwater Quality Standard. However, the detection limit indicated meets the approved PQL in the CDAP of 0.05 ug/l.

TABLE 6-1
TREND ANALYSIS OF GROUNDWATER RESULTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Monitoring Well ID	Area	OBG (1) Results (ug/l)	D&M (2) Results (ug/l)	Weston R1 Results (ug/l)	Weston R2 Results (ug/l	Trend
TOTAL VOCs						
MW-6	19	ND	ND	1.00	—	No Change
MW-7	01	5.00	5.20	8.00	—	Increasing
MW-8	01	178.00	137.30	96.00	—	Decreasing
MW-9	01	7.00	12.00	8.00	—	Varies
MW-11	07	ND	103.30	162.00	—	Increasing
MW-13	02	61.00	468.00	565.00	—	Increasing
MW-14	03	6.00	5.40	9.00	—	Increasing
MW-31	01	267.00	139.60	61.00	—	Decreasing
MW-40	BKG	—	16.80	—	22.00	Increasing
MW-42A	04	—	ND	2.00	—	Increasing
MW-46A	10	—	188.40	161.80	—	Decreasing
MW-47A	09	—	264.20	148.70	—	Decreasing
MW-48A	09	—	ND	33.00	—	Increasing
MW-48B	09	—	30.00	33.00	—	No Change
MW-58	03	—	249.00	123.00	—	Decreasing
MW-59	07	—	622.00	580.00	—	Decreasing
MW-62	06	—	38.40	ND	—	Decreasing
MW-63	12	—	34.00	ND	—	Decreasing
MW-67	05	—	—	ND	1.10	No Change
MW-69A	XHW	—	—	5.00	ND	Decreasing
MW-80A	09	—	—	11.00	12.00	No Change
MW-83A	15	—	—	1.00	ND	Decreasing
MW-84A	15	—	—	28.00	36.00	Increasing
MW-87A	18D	—	—	12.00	7.00	Decreasing
MW-87C	18D	—	—	17.00	ND	Decreasing
MW-88A	18C	—	—	21.00	13.00	Decreasing
MW-89A	18C	—	—	ND	1.60	Increasing
MW-91A	16	—	—	31.00	33.00	No Change
MW-92B	16	—	—	16.00	19.00	No Change
MW-95A	06	—	—	1.00	ND	No Change
MW-96A	06	—	—	1.00	2.00	Increasing
MW-96C	06	—	—	6.00	ND	Decreasing
MW-101A	11	—	—	6.10	4.00	Decreasing
MW-103A	BKG	—	—	55.00	64.00	Increasing
MW-105A	BKG	—	—	4.00	3.00	No Change
PCE						
MW-11	07	ND	ND	3.00	—	Increasing
MW-13	02	ND	23.00	10.00 U	—	Decreasing
MW-40	BKG	—	3.50	—	3.00	No Change
MW-48A	09	—	ND	16.00	—	Increasing
MW-48B	09	—	ND	3.00	—	Increasing
MW-58	03	—	11.00	13.00	—	No Change
MW-87A	01	—	—	2.00	2.00	No Change
MW-103A	BKG	—	—	8.00	8.00	No Change

Notes:

(1): O'Brien & Gere Final Engineering Report, Former Raritan Arsenal (Novebmer 1989).
(2): Dames & Moore Final Report, Phase I Remedial Investigation of Selected Areas of Former Raritan Arsenal (April 19
ND: Not Detected
— Results not available.

TABLE 6-1
TREND ANALYSIS OF GROUNDWATER RESULTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Monitoring Well ID	Area	OBG (1) Results (ug/l)	D&M (2) Results (ug/l)	Weston R1 Results (ug/l)	Weston R2 Results (ug/l	Trend
TCE						
MW-7	01	5.00	5.20	5.00	——	No Change
MW-8	01	170.00	130.00	82.00	——	Decreasing
MW-9	01	3.00	ND	2.00	——	Decreasing
MW-11	07	ND	11.00	9.00	——	Decreasing
MW-13	02	43.00	310.00	300.00	——	Increasing
MW-14	03	6.00	5.40	7.00	——	No Change
MW-31	01	250.00	130.00	48.00	——	Decreasing
MW-40	BKG	——	9.00	——	8.00	Decreasing
MW-46A	10	——	29.00	27.00	——	Decreasing
MW-47A	09	——	95.00	30.00	——	Decreasing
MW-48A	09	——	ND	8.00	——	Increasing
MW-48B	09	——	30.00	24.00	——	Decreasing
MW-58	03	——	170.00	110.00	——	Decreasing
MW-59	07	——	20.00	13.00	——	Decreasing
MW-80A	09	——	——	11.00	12.00	No Change
MW-84A	15	——	——	8.00	8.00	No Change
MW-87A	18D	——	——	7.00	5.00	Decreasing
MW-88A	18C	——	——	4.00	3.00	No Change
MW-91A	16	——	——	28.00	32.00	No Change
MW-103A	BKG	——	——	7.00	8.00	No Change
MW-105A	BKG	——	——	4.00	3.00	No Change
TOTAL 1,2-DCE						
MW-7	01	ND	ND	3.00	——	Increasing
MW-8	01	8.00	7.30	14.00	——	Increasing
MW-9	01	4.00	12.00	6.00	——	Varies
MW-11	07	ND	18.00	16.00	——	No Change
MW-13	02	18.00	120.00	180.00	——	Increasing
MW-14	03	ND	ND	2.00	——	Increasing
MW-31	01	17.00	9.60	13.00	——	Varies
MW-40	BKG	——	4.30	——	11.00	Increasing
MW-46A	10	——	130.00	120.00	——	No Change
MW-47A	09	——	160.00	110.00	——	Decreasing
MW-48A	09	——	ND	9.00	——	Increasing
MW-48B	09	——	ND	6.00	——	Increasing
MW-58	03	——	68.00	1.00 U	——	Decreasing
MW-59	07	——	17.00	21.00	——	Increasing
MW-83A	15	——	——	1.00	1.00 U	No Change
MW-84A	15	——	——	18.00	22.00	Increasing
MW-88A	18C	——	——	17.00	10.00	Decreasing
MW-91A	16	——	——	3.00	2.00	No Change
MW-92B	16	——	——	13.00	19.00	Increasing
MW-96A	06	——	——	1.00	2.00	No Change
MW-103A	BKG	——	——	40.00	48.00	Increasing

Notes:

(1): O'Brien & Gere Final Engineering Report, Former Raritan Arsenal (Novebmer 1989).
(2): Dames & Moore Final Report, Phase I Remedial Investigation of Selected Areas of Former Raritan Arsenal (April 19
ND: Not Detected
—— Results not available.

TABLE 6-1
TREND ANALYSIS OF GROUNDWATER RESULTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Monitoring Well ID	Area	OBG (1) Results (ug/l)	D&M (2) Results (ug/l)	Weston R1 Results (ug/l)	Weston R2 Results (ug/l	Trend
ARSENIC						
MW-6	19	40.00	8.60	4.80	——	Decreasing
MW-7	01	ND	10.70	6.50	——	Decreasing
MW-9	01	ND	12.80	2.10	——	Decreasing
MW-10	20	ND	42.70	2.70	——	Decreasing
MW-11	07	ND	3.60	1.70 U	——	Decreasing
MW-13	02	ND	2.80	1.70 U	——	Decreasing
MW-15	03	ND	13.10	1.70 U	——	Decreasing
MW-16	06A	ND	7.10	8.20 J-	——	No Change
MW-17	04	ND	6.50	4.30 J-	——	Decreasing
MW-20	05	ND	2.90	1.70 UJ	——	Decreasing
MW-25	06A	ND	18.80	12.80 J-	——	Decreasing
MW-26	06A	ND	3.30	1.70 UJ	——	Decreasing
MW-27	06A	20.00	18.00	16.20 J-	——	Decreasing
MW-28	11	ND	57.70	29.20 J-	——	Decreasing
MW-29	11	20.00	46.70	66.40 J-	——	Increasing
MW-30	11	40.00	63.00	78.00 J-	——	Increasing
MW-34	06B	ND	ND	1.80 J-	——	Increasing
MW-42A	04	——	5.40	6.10 J	——	No Change
MW-44	06A	——	9.30	1.70 UJ	——	Decreasing
MW-45	14	——	2.30	3.10 J-	——	No Change
MW-46A	10	——	3.00	1.70 U	——	Decreasing
MW-47A	09	——	15.30	7.60	——	Decreasing
MW-47C	09	——	——	2.40	2.20	No Change
MW-48A	09	——	8.50	1.70 U	——	Decreasing
MW-50	14	——	173.00	398.00 J-	——	Increasing
MW-50B	14	——	——	5.30 J-	3.40	Decreasing
MW-51	16	——	17.10	21.50 J	——	Increasing
MW-52A	16	——	ND	4.30 J-	——	Increasing
MW-52B	16	——	10.20	9.10 J-	——	No Change
MW-53	16	——	3.40	4.90 J-	——	No Change
MW-54	19	——	12.70	6.60 J	——	Decreasing
MW-60	14	——	4.30	5.20 J	——	No Change
MW-60B	14	——	——	13.80 J	5.40 J-	Decreasing
MW-60C	14	——	——	2.00	3.80 J-	Increasing
MW-61	04	——	15.90	18.90	——	Increasing
MW-62	06	——	3.50	2.60	——	Decreasing
MW-63	12	——	8.40	34.00 UJ	——	Unknown
MW-63A	14	——	——	2.00 J-	1.90 U	No Change
MW-65	05	——	——	3.00 J-	1.70 UJ	Decreasing
MW-67	05	——	——	17.10 J-	3.60 J-	Decreasing
MW-69A	XHW	——	——	3.40	2.20 J-	Decreasing
MW-75C	04	——	——	1.70 U	2.10	Increasing
MW-76A	04	——	——	3.60	5.20	Increasing
MW-76B	04	——	——	9.70	11.10	No Change
MW-76C	04	——	——	1.70 U	2.40	Increasing
MW-77A	14	——	——	17.00	5.60	Decreasing
MW-77B	14	——	——	7.20	2.90	Decreasing

Notes:

(1): O'Brien & Gere Final Engineering Report, Former Raritan Arsenal (Novebmer 1989).

(2): Dames & Moore Final Report, Phase I Remedial Investigation of Selected Areas of Former Raritan Arsenal (April 19

ND: Not Detected

—— Results not available.

TABLE 6-1
TREND ANALYSIS OF GROUNDWATER RESULTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Monitoring Well ID	Area	OBG (1) Results (ug/l)	D&M (2) Results (ug/l)	Weston R1 Results (ug/l)	Weston R2 Results (ug/l	Trend
ARSENIC (continued)						
MW-78A	14	----	----	4.70	2.40	Decreasing
MW-79B	08	----	----	5.20 J	1.90	Decreasing
MW-85A	15	----	----	1.70 U	2.00	No Change
MW-88A	18D	----	----	1.70 U	1.80	No Change
MW-88C	18C	----	----	1.70 U	1.70 U	No Change
MW-89A	01	----	----	2.30 J-	4.10 J-	Increasing
MW-90A	16	----	----	11.70 J	5.20 J-	Decreasing
MW-90C	16	----	----	2.00	8.50 U	Increasing
MW-91A	16	----	----	11.20 J-	12.30 J-	No Change
MW-91B	16	----	----	9.50 J-	2.40 J-	Decreasing
MW-92B	16	----	----	6.00 J	3.90 J-	Decreasing
MW-93A	16	----	----	8.50 UJ	12.40 J-	Increasing
MW-94A	06	----	----	11.40	15.50 J-	Increasing
MW-95A	06	----	----	3.40	3.50 J-	No Change
MW-96A	06	----	----	6.20	6.50	No Change
MW-97A	06A	----	----	10.60 J-	22.50	Increasing
MW-98A	06B	----	----	14.80 J-	15.20	No Change
MW-98B	06B	----	----	4.30 J-	1.70 U	Decreasing
MW-99A	06B	----	----	28.60 J-	16.90	Decreasing
MW-100A	11	----	----	26.50 J	1.90 U	Decreasing
MW-101A	11	----	----	17.00 J	20.60	No Change
MW-103C	BKG	----	----	3.10	2.40	No Change
MW-104C	BKG	----	----	5.20	3.20	Decreasing
MW-105C	BKG	----	----	1.70 U	1.80	No Change
LEAD						
MW-6C	09	----	----	2.30	1.70 U	Decreasing
MW-7	01	ND	9.20	6.90	----	Decreasing
MW-8	01	ND	3.20	3.90	----	No Change
MW-9	01	6.00	11.00	5.20	----	Varies
MW-12	07	ND	2.80	6.70 U	----	Unknown
MW-13	02	5.00	3.10	2.40 U	----	Decreasing
MW-14	03	ND	2.00	3.40	----	Increasing
MW-15	03	ND	6.00	2.80 U	----	Decreasing
MW-17	04	16.00	3.50	1.60 UJ	----	Decreasing
MW-18	04	ND	3.00	2.30 U	----	Decreasing
MW-19	04	ND	ND	2.40	----	Increasing
MW-20	05	ND	6.40	4.20 U	----	Decreasing
MW-22	05	ND	2.10	2.60 U	----	No Change
MW-27	06A	ND	2.20	1.60 UJ	----	Decreasing
MW-28B	11	----	----	1.60 UJ	4.40 J	Increasing
MW-29	11	11.00	ND	1.60 UJ	----	Decreasing
MW-30	11	11.00	ND	1.60 UJ	----	Decreasing
MW-31	01	ND	199.00	3.30	----	Decreasing
MW-34	06B	ND	3.70	1.60 UJ	----	Decreasing
MW-40	BKG	----	ND	----	2.30	Increasing
MW-42A	04	----	11.10	1.60 U	----	Decreasing
MW-43	04	----	7.80	13.70	----	Increasing
MW-44	06A	----	4.90	1.80 J-	----	Decreasing
MW-45	14	----	11.90	3.80 U	----	Decreasing
MW-46A	10	----	4.70	2.90 U	----	Decreasing
MW-47A	09	----	3.60	3.50 U	----	Decreasing

Notes:

(1): O'Brien & Gere Final Engineering Report, Former Raritan Arsenal (Novebmer 1989).

(2): Dames & Moore Final Report, Phase I Remedial Investigation of Selected Areas of Former Raritan Arsenal (April 19

ND: Not Detected

---- Results not available.

TABLE 6-1
TREND ANALYSIS OF GROUNDWATER RESULTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Monitoring Well ID	Area	OBG (1) Results (ug/l)	D&M (2) Results (ug/l)	Weston R1 Results (ug/l)	Weston R2 Results (ug/l	Trend
LEAD (continued)						
MW-48A	09	—	12.10	2.90	—	Decreasing
MW-48B	09	—	2.80	1.60 U	—	Decreasing
MW-50	14	—	43.90	6.10 J-	—	Decreasing
MW-50C	14	—	—	1.80 J-	3.00 U	Unknown
MW-52A	16	—	ND	14.50 J-	—	Increasing
MW-52B	16	—	3.80	1.60 UJ	—	Decreasing
MW-54	19	—	48.50	12.50 U	—	Decreasing
MW-56	10	—	2.20	3.20 U	—	Unknown
MW-57	10	—	ND	11.10 J-	—	Increasing
MW-58	03	—	7.70	1.60 U	—	Decreasing
MW-59	07	—	12.00	2.00 U	—	Decreasing
MW-61	04	—	3.90	2.00 U	—	Decreasing
MW-62	06	—	10.90	1.60 U	—	Decreasing
MW-63	12	—	2.60	1.60 UJ	—	Decreasing
MW-63A	14	—	—	10.40 J-	3.10 J	Decreasing
MW-69A	XHW	—	—	31.60 J-	2.30 U	Decreasing
MW-76A	04	—	—	20.30	18.60 U	No Change
MW-76B	04	—	—	3.90	7.90 U	Increasing
MW-77A	14	—	—	2.90	2.60 U	No Change
MW-77B	14	—	—	7.10	5.00 U	Decreasing
MW-78A	14	—	—	3.40	5.20 U	Unknown
MW-79B	08	—	—	1.60 U	3.50 J	Increasing
MW-79C	08	—	—	2.00 U	4.20	Increasing
MW-80A	09	—	—	5.80 U	3.30 J	Unknown
MW-82A	OI	—	—	1.60 U	2.40	Increasing
MW-84A	15	—	—	1.60 U	2.60	Increasing
MW-87A	18D	—	—	1.60 UJ	1.60	No Change
MW-88A	18C	—	—	2.40 U	3.40	Increasing
MW-100A	11	—	—	239.00 U	5.40	Unknown
MW-104C	BKG	—	—	5.10 U	2.90	Unknown
MW-105A	BKG	—	—	4.00 U	5.70	Increasing
CADMIUM						
MW-14	03	ND	ND	2.80	—	Increasing
MW-15	03	ND	5.00	1.00 U	—	Decreasing
MW-16	06A	11.00	ND	1.00 U	—	Decreasing
MW-20	05	ND	ND	1.10	—	Increasing
MW-21	05	ND	ND	2.20	—	Increasing
MW-22	05	ND	ND	3.20	—	Increasing
MW-42A	04	—	5.00	1.00 U	—	Decreasing
MW-47A	09	—	23.00	1.00 U	—	Decreasing
MW-48A	09	—	6.00	1.20	—	Decreasing
MW-57	10	—	ND	1.10	—	Increasing
MW-58	03	—	ND	1.40	—	Increasing
MW-59	07	—	17.00	1.00 U	—	Decreasing

Notes:

(1): O'Brien & Gere Final Engineering Report, Former Raritan Arsenal (Novebmer 1989).
(2): Dames & Moore Final Report, Phase I Remedial Investigation of Selected Areas of Former Raritan Arsenal (April 19
ND: Not Detected
— Results not available.

TABLE 6-1
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FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Monitoring Well ID	Area	OBG (1) Results (ug/l)	D&M (2) Results (ug/l)	Weston R1 Results (ug/l)	Weston R2 Results (ug/l	Trend
			CADMIUM (continued)			
MW-60B	14	—	—	1.00 U	2.20 J-	Increasing
MW-60C	14	—	—	1.20	2.00 U	Unknown
MW-61	04	—	8.00	1.00 U	—	Decreasing
MW-65	05	—	—	1.20	2.00 J-	Increasing
MW-66	05	—	—	4.00	4.30 J+	No Change
MW-67	05	—	—	2.00 U	5.00 J-	Increasing
MW-69A	XHW	—	—	1.20	2.00 UJ	No Change
MW-75A	04	—	—	1.00 U	1.20	No Change
MW-78A	14	—	—	1.00 U	2.10	Increasing
MW-80A	09	—	—	1.40	2.10	Increasing
MW-89A	01	—	—	2.00 U	3.00 J-	Increasing
MW-90C	16	—	—	1.50	2.00 UJ	Unknown
MW-91A	16	—	—	1.30	2.00 UJ	Unknown
MW-91B	16	—	—	1.80	3.00 J-	Increasing
MW-94A	06	—	—	1.10	2.00 J-	Increasing
MW-95A	06	—	—	2.00 U	2.00 J-	No Change
MW-96C	06	—	—	1.00	2.00 U	Unknown
MW-100A	11	—	—	1.50	2.00 U	Unknown
			CHROMIUM			
MW-6C	09	—	—	7.70	21.40	Increasing
MW-7	01	ND	ND	12.90	—	Increasing
MW-9	01	ND	8.00	6.40 U	—	Decreasing
MW-10	20	11.00	ND	6.40 U	—	Decreasing
MW-12	07	48.00	ND	6.40 U	—	Decreasing
MW-13	02	ND	9.70	6.40 U	—	Decreasing
MW-14	03	14.00	ND	6.40 U	—	Decreasing
MW-16	06A	31.00	ND	8.90	—	Decreasing
MW-17	04	ND	23.00	6.40 U	—	Decreasing
MW-18	04	23.00	ND	6.40 U	—	Decreasing
MW-20	05	35.00	23.50	6.40 U	—	Decreasing
MW-21	05	20.00	ND	6.40 U	—	Decreasing
MW-25	06A	10.00	ND	6.40 U	—	Decreasing
MW-26	06A	10.00	ND	6.40 U	—	Decreasing
MW-28	11	30.00	ND	6.40 U	—	Decreasing
MW-29	11	20.00	ND	6.40 U	—	Decreasing
MW-30	11	20.00	ND	6.40 U	—	Decreasing
MW-31	01	10.00	ND	6.40 U	—	Decreasing
MW-34	06B	20.00	ND	6.40 U	—	Decreasing
MW-42A	04	—	49.00	6.40 U	—	Decreasing
MW-43	04	—	ND	14.50	—	Increasing
MW-44	06A	—	13.00	6.40 U	—	Decreasing
MW-45	14	—	9.00	6.40 U	—	Decreasing
MW-46A	10	—	18.60	6.40 U	—	Decreasing
MW-48A	09	—	35.00	6.40 U	—	Decreasing
MW-50	14	—	45.00	26.10	—	Decreasing
MW-51	16	—	10.70	6.40 U	—	Decreasing
MW-52A	16	—	ND	7.60	—	Increasing
MW-53	16	—	ND	8.60	—	Increasing
MW-54	19	—	131.00	50.50 J	—	Decreasing

Notes:

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(2): Dames & Moore Final Report, Phase I Remedial Investigation of Selected Areas of Former Raritan Arsenal (April 19

ND: Not Detected

— Results not available.

TABLE 6-1
TREND ANALYSIS OF GROUNDWATER RESULTS
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

Monitoring Well ID	Area	OBG (1) Results (ug/l)	D&M (2) Results (ug/l)	Weston R1 Results (ug/l)	Weston R2 Results (ug/l	Trend
			CHROMIUM (continued)			
MW-58	03	—	37.00	6.40 U	—	Decreasing
MW-59	07	—	62.00	6.40 U	—	Decreasing
MW-61	04	—	25.00	13.80	—	Decreasing
MW-62	06	—	ND	11.80	—	Increasing
MW-63A	14	—	—	29.70	6.40 U	Decreasing
MW-67	05	—	—	6.40 U	11.40	Increasing
MW-68A	118	—	—	10.20	20.90	Increasing
MW-69A	XHW	—	—	83.20	8.10	Decreasing
MW-75A	04	—	—	7.90	11.50 U	Unknown
MW-76A	04	—	—	34.00	35.30 U	Unknown
MW-77B	14	—	—	8.10	10.70 U	Unknown
MW-78A	14	—	—	23.70	6.40 U	Decreasing
MW-79C	08	—	—	6.40 U	15.20	Increasing
MW-80A	09	—	—	6.40 U	7.30	Increasing
MW-82A	OI	—	—	8.50	11.20	Increasing
MW-88A	18C	—	—	6.40 U	7.30	Increasing
MW-89A	01	—	—	15.00	40.10	Increasing
MW-90C	16	—	—	10.10	12.80 U	Unknown
MW-92B	16	—	—	6.40 U	11.20	Increasing
MW-95A	06	—	—	11.40	6.40 U	Decreasing
MW-96A	06	—	—	7.00	6.40 U	Decreasing
MW-96C	06	—	—	17.40	12.80 U	Decreasing
MW-97A	06A	—	—	22.20	6.40 U	Decreasing
MW-100A	11	—	—	271.00 J	13.60	Decreasing
MW-104C	BKG	—	—	13.10	25.10	Increasing
MW-105A	BKG	—	—	11.70	8.00	Decreasing

Notes:

(1): O'Brien & Gere Final Engineering Report, Former Raritan Arsenal (Novebmer 1989).
(2): Dames & Moore Final Report, Phase I Remedial Investigation of Selected Areas of Former Raritan Arsenal (April 19
ND: Not Detected
— Results not available.

TABLE 6-2

SUMMARY OF DNAPL-RELATED COMPOUNDS COMPARED TO PURE PHASE SOLUBILITY FORMER RARITAN ARSENAL EDISON, NEW JERSEY

DNAPL-Related Compound	Highest Concentration Detected in Groundwater[4] (mg/L)	Sample Location	Pure Phase Solubility mg/L	1% of Pure Phase Solubility mg/L
1,1-Dichloroethane	0.028	MW-11	5100[1]	51
1,1-Dichloroethene	0.002	MW-SA5	200[1]	2
1,2-Dichloroethane	0.016	MW-59	8000[1]	80
Chlorobenzene	0.45	MW-59	490[1]	4.9
Chloroform	0.001	MW-87A	8000[2]*	80
Tetrachloroethene	0.031	MW-81A	150[2]	1.5
Total 1,2-Dichloroethene	0.26	MW-81A	600[2]**	6
Trichloroethene	0.59	MW-81A	1000[1]	10
1,1,1-Trichloroethane	0.15	SGW-12	1300[1]	13
1,1,2-Trichloroethane	0.0051	SGW-12	4500[2]	45
1,1,2,2-Tetrachloroethane	0.0024	SGW-204[3]	2900[2]	29
1,1-Dichloroethane	0.065	SWG-112	5100[1]	51
1,1-Dichloroethene	0.030	SGW-12	200[1]	2
Chlorobenzene	0.058	SGW-45	490[1]	4.9
Chloroform	0.0029	SGW-7	8000[2]*	80
Tetrachloroethene	1.8	SGW-110	150[2]	1.5
Total 1,2-Dichloroethene	4.8	SGW-94	600[2]**	6
Trichloroethene	8.0	SGW-94	1000[1]	10

(1) Taken from Lange's Handbook of Chemistry
(2) Taken from Handbook of Environmental Data on Organic Chemicals
(3) QA/QC duplicate of sample GW-SGW-120
(4) Based on results of SGWS investigation and Round 1 groundwater sampling event.
* At 20°C
** Pure phase solubility for trans-1,2-dichloroethene

TABLE 6-3

SUMMARY OF KNOWN CONTAMINATED SITES
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SITE NAME	STREET ADDRESS	LEAD/CONTACT	STATUS	IDENTIFIER	COMMENTS
SITES WITHIN BOUNDARY OF FORMER ARSENAL					
AMERICAN HOSPITAL SUPPLY CORP.	551 RARITAN CENTER PKWY. EDISON, NJ	BEECRA-E93218 BEECRA-E93221	ACTIVE 5-3-93	NJP000858142	LOCATION UNKNOWN
BAXTER HEALTHCARE CORP.	100 TO 200 RARITAN CENTER PKWY. EDISON, NJ	BEECRA-E93224	ACTIVE	NJL000049940	UPGRADIENT AREAS 15 AND 14
BLUESPRUCE II	653 RARITAN CENTER PKWY. EDISON, NJ	BFO-C-921270	PENDING 12/21/92	NJD980769988	LOCATION UNKNOWN WITHIN AREA 16
CARY CHEMICALS INC.	BUILDING 443 RARITAN CENTER EDISON, NJ	BEECRA-E84256	ACTIVE 2/28/90	NJD002562247	WITHIN AREA 19
CENTER REALTY	300 RARITAN CENTER PKWY. EDISON, NJ	BSCM-NJD020777181	ACTIVE 1/1/80	NJD020777181	PCB OIL SPILL WITHIN AREA 20 AT BUILDING 455
FEDERAL STORAGE WAREHOUSE LANDFILL	KING GEORGES POST RD. EDISON, NJ	BFO-CA-9304124	PENDING 6/2/93	NJL000064600	UPGRADIENT AREA 15
FIELDCREST AVENUE MONITOR WELLS	1 RARITAN CENTER PKWY. EDISON, NJ	BFCM-1110	ACTIVE 11/12/90	NJL000039446	UPGRADIENT LOCATION
GARON PRODUCTS INC.	RARITAN CENTER PKWY. EDISON, NJ	BEECRA-E91222	ACTIVE 8/14/91	NJD042909499	LOCATION UNKNOWN
RARITAN CENTER	RARITAN CENTER PKWY. AND WOODBRIDGE AVE. EDISON, NJ	BFCM-NJ1680090015	ACTIVE 4/1/92	NJ1680090015	FORMER RARITAN ARSENAL
RARITAN CENTER	104 SUNFIELD AVE. EDISON, NJ	BUST-0155937	ACTIVE 12/30/91	NJL600098313	WITHIN AREA 9 EDGE OF AREA 19 PLUME (AOC?)
RARITAN PERIODICAL SALES	125 CLEARVIEW AVE. EDISON, NJ	BUST-0031169	ACTIVE 3/24/93	NJL000059758	UPGRADIENT AREA 14 SIDEGRADIENT AREA 15

TABLE 6-3 (continued)

SUMMARY OF KNOWN CONTAMINATED SITES
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SITE NAME	STREET ADDRESS	LEAD/CONTACT	STATUS	IDENTIFIER	COMMENTS
UNITED PARCEL SERVICE	1 CLOVER PLACE EDISON, NJ	BUST-0015437	ACTIVE 8/28/89	NJD070415658	SIDEGRADIENT AREA 4 UPGRADIENT AREA 5 AND AREA 14
WAKEFERN CORP.	CAMPUS PLAZA 7 RARITAN CENTER PKWY. EDISON, NJ	BFO-C 930809133056	ACTIVE 8/9/93	NJD986596716	UPGRADIENT AREAS 20, 7, & 8 SIDEGRADIENT AREA 2
LJ&M LAPLACE CHEMICAL CO.	PATROL RD. WOODBRIDGE, NJ	BEECRA-E88488	ACTIVE 5/27/93	NJL500036090	WITHIN AREA 6A DRAINAGE AREA 3
SITES ADJACENT TO FORMER ARSENAL					
ENGELHARD	40 NIXON LANE EDISON, NJ	BEECRA-E85375	ACTIVE 4/19/90	NJD063138531	WEST OF FORMER ARSENAL BOUNDARY SIDEGRADIENT AREA X, H, & W. UPGRADIENT AREA 19, 16, & 12.
ILR SANITARY LANDFILL	MILL RD. EDISON, NJ	BFO-CA 9303234	PENDING 6/25/93	NJD980505275	WEST OF FORMER ARSENAL BOUNDARY UPGRADIENT AREA 16 AND 12
NJ STATE POLICE EDISON TOWNSHIP	2667 WOODBRIDGE AVE. EDISON, NJ	BAC-0163316	ACTIVE 7/26/93	NJD982728479	NORTH OF FORMER ARSENAL BOUNDARY (UPGRADIENT) AREA 18 AND BLDG 118.
VALVOLINE INC.	200 MILL RD. EDISON, NJ	BEECRA-E90681	ACTIVE 12/16/91	NJD051304111	WEST OF FORMER ARSENAL BOUNDARY.
ASHLAND CHEMICAL CO.	MEADOW RD. WOODBRIDGE, NJ	BFCM-NJD000531855	ACTIVE 2/7/92	NJD000531855	EAST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER, SIDEGRADIENT AREA 15 & 14.

TABLE 6-3 (continued)

SUMMARY OF KNOWN CONTAMINATED SITES
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SITE NAME	STREET ADDRESS	LEAD/CONTACT	STATUS	IDENTIFIER	COMMENTS
HATCO CHEMICAL CORP.	KING GEORGES POST RD. WOODBRIDGE, NJ	BFCM-NJD091399329	ACTIVE 9/9/92	NJD091399329	EAST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER SIDEGRADIENT AREA 14 & 15.
NUODEX INC.	INDUSTRIAL HWY. WOODBRIDGE, NJ	BEECRA-E85161 BEECRA-E89475	ACTIVE 7/16/85 ACTIVE 8/9/89	NJD002184562	EAST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER SIDEGRADIENT AREA 14
PMC SPECIALTIES	INDUSTRIAL HWY. WOODBRIDGE, NJ	BEECRA-931020151058	ACTIVE 10/20/93	NJD042912287	EAST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER SIDEGRADIENT AREA 14
PRAXAIR INC.	INDUSTRIAL HWY. WOODBRIDGE, NJ	BEECRA-E92369	ACTIVE 10/19/92	NJL500036249	EAST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER SIDEGRADIENT AREA 14
SHERWIN WILLIAMS CO.	INDUSTRIAL HWY. WOODBRIDGE, NJ	BEECRA-E84288	ACTIVE 4/1/91	NJD980770671	EAST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER SIDEGRADIENT AREA 14
RARITAN VALLEY BUS SERVICE	115 MAIN ST. EDISON, NJ	BUST-0111575	ACTIVE 2/6/86	NJL600070098	NORTH OF FORMER ARSENAL BOUNDARY
BAXTER HEALTHCARE CORP.	49 DISTRIBUTION BLVD. EDISON, NJ	BAC-E92650	ACTIVE 6/29/93	NJX000241406	WEST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER
ELBETH LIMITED	321 MEADOW RD. EDISON, NJ	BEECRA-E85539	ACTIVE 3/10/86	NJD980594022	WEST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER

TABLE 6-3 (continued)

SUMMARY OF KNOWN CONTAMINATED SITES
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SITE NAME	STREET ADDRESS	LEAD/CONTACT	STATUS	IDENTIFIER	COMMENTS
EDISON TOWNSHIP MUNICIPAL LANDFILL	MEADOW RD. EDISON, NJ	BFO-CA-9304102	PENDING 6/2/93	NJD000571505	WEST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER
KIN-BUC LANDFILL	383 MEADOW RD. EDISON, NJ	BFCM-NJD049860836 EPA-M227	ACTIVE ACTIVE 4/1/92	NJD049860836	WEST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER
STAUFFER CHEMICAL	MEADOW RD. EDISON, NJ	BEECRA-E87815 BEECRA-E87579 BEECRA-E85156	ACTIVE 3/16/88 ACTIVE 4/30/90 ACTIVE 7/15/92	NJD052204633	WEST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER
TWIN COUNTY GROCERS INC.	25 EXECUTIVE AVE. EDISON, NJ	BUST-0025184	ACTIVE 6/1/90	NJD006973101	WEST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER
PRAXAIR INC.	CROWS MILL RD. WOODBRIDGE, NJ	BEECRA-E92372	ACTIVE 10/13/92	NJL500036264	EAST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER
STANDARD OIL	CROWS MILL RD. WOODBRIDGE, NJ	BSCM-920819	PENDING 8/14/92	NJD002170017	

TABLE 6-4

SUMMARY OF U.S. EPA REGION II CERCLIS SITES
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SITE NAME	EPA IDENTIFICATION #	STREET ADDRESS	COMMENTS
CERCLIS SITES WITHIN BOUNDARIES OF FORMER ARSENAL			
EDISON CENTER REALTY	NJD982272684	FED BUS CENTER 300 RARITAN CENTER EDISON, NJ	DOWNGRADIENT AREA 7 UPGRADIENT AREA 6
I.T. CORP	NJ4680019987	GSA RARITAN DEPOT EDISON, NJ	LOCATION UNKNOWN, WITHIN U.S.EPA FACILITY, MAY REFER TO AREA 18A
PETROLEUM CHEMICAL TECHNOLOGY INC.	NJD980529606	BLDG 455 RARITAN CENTER EDISON, NJ	WITHIN AREA 20 BELIEVED TO BE BLDG 455 IN AREA 20 - CENTER REALTY
RARITAN ARSENAL	NJD986589190	WOODBRIDGE AVE. EDISON, NJ	FORMER RARITAN ARSENAL
RARITAN CENTER - AREA 4	NJD986571362	WOODBRIDGE AVE. EDISON, NJ	DOWNGRADIENT AREA 3 UPGRADIENT AREA 5
RARITAN CENTER - AREA 5	NJD986573970	RARITAN CENTER EDISON, NJ	DOWNGRADIENT AREA 4 UPGRADIENT AREAS 14 AND 6
BLUE SPRUCE	NJD980769988	BLDG 652 RARITAN CENTER EDISON, NJ	BUILDING 652 WITHIN AREA 16
GSA RARITAN DEPOT	NJ3470009009	WOODBRIDGE AVE. EDISON, NJ	WITHIN U.S.EPA FACILITY AREA 18A-18G EXACT LOCATION UNKNOWN
CERCLIS SITES ADJACENT TO FORMER ARSENAL			
ELIZABETH WASTE DISPOSAL #1	NJD980505119	CROWS MILL RD. KEASBY, NJ	EAST OF FORMER ARSENAL BOUNDARY

TABLE 6-4 (continued)

SUMMARY OF U.S. EPA REGION II CERCLIS SITES
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SITE NAME	EPA IDENTIFICATION #	STREET ADDRESS	COMMENTS
ELIZABETH WASTE DISPOSAL #2	NJD980505101	KING GEORGE RD. FORDS, NJ	NORTHEAST OF FORMER ARSENAL BOUNDARY
ELIZABETH WASTE DISPOSAL #3 (KEASBY LF RT 440 KEASBY)	NJD980640783	SMITH ST. KEASBY, NJ	EAST OF FORMER ARSENAL BOUNDARY
HATCO CHEMICAL (WR GRACE & CO)	NJD091399329	KING GEORGES POST RD. FORDS, NJ	EAST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER SIDEGRADIENT AREAS 14 AND 15
METRO DISPOSAL SERVICES	NJD075130815	SMITH ST. & CROWS MILL RD. KEASBY, NJ	EAST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER
NUODEX INC (TENNECO CHEMICALS, INC./FORDS PLANT; TENNECO CHEMICAL INC/HAYDEN DIV; TENNECO CHEMICALS INC; NUODEX,INC (NJD980770622) INDUSTRIAL HIGHWAY)	NJD002184562	MEADOW RD. FORDS, NJ	EAST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER SIDEGRADIENT AREA 14
SHERWIN WILLIAMS	NJD980770671	INDUSTRIAL HWY. WOODBRIDGE, NJ	EAST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER SIDEGRADIENT AREA 14
TENNECO POLYMERS, INC.	NJD986603892	INDUSTRIAL AVE & OLD MEADOW RD. FORDS, NJ	EAST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER SIDEGRADIENT AREA 14
EDISON TWP LF	NJD980529044	MEADOW RD. EDISON, NJ	WEST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER

TABLE 6-4 (continued)

SUMMARY OF U.S. EPA REGION II CERCLIS SITES
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SITE NAME	EPA IDENTIFICATION #	STREET ADDRESS	COMMENTS
HELLER PROPERTIES	NJD981187065	EXECUTIVE AVE. & MEADOW RD. EDISON, NJ	WEST OF FORMER ARSENAL BOUNDARY
INDUSTRIAL LAND RECLAIMING	NJD980505275	MILL LANE EDISON, NJ	WEST OF FORMER ARSENAL BOUNDARY UPGRADIENT AREAS 16 AND 12
KIN-BUC LANDFILL (KIN BUC LANDFILL; KIN-BUC LF)	NJD049860836	MEADOW RD. EDISON, NJ	WEST OF FORMER ARSENAL BOUNDARY UPGRADIENT RARITAN RIVER
KTK CORP.	NJD986615813	MEADOW RD. EDISON, NJ	WEST OF FORMER ARSENAL BOUNDARY
STAUFFER CHEMICAL CO.(AKZO CHEMICALS, INC.)	NJD052204633	MEADOW RD. EDISON, NJ	WEST OF FORMER ARSENAL BOUNDARY
NUODEX INC (TENNECO NIXON PLANT, NIXON LANE)	NJD063138531	40 NIXON LANE EDISON, NJ	WEST OF FORMER ARSENAL BOUNDARY SIDEGRADIENT AREA 19 UPGRADIENT AREAS 16 AND 12

TABLE 6-5

SUMMARY OF REGISTERED UNDERGROUND STORAGE TANKS
WITHIN THE FORMER ARSENAL
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SITE NAME	STREET ADDRESS	UST NUMBER	COMMENTS
AMERICAN GROCERY COMPANY.	141 FIELDCREST AVENUE EDISON, NJ	0197913	WITHIN BUILDING 151 AOC.
APPLAUSE, INC.	180 RARITAN CENTER PARKWAY EDISON, NJ	0226659	UPGRADIENT AREA 4 AND 5.
BAXTER HEALTHCARE CORPORATION	120 RARITAN CENTER PARKWAY EDISON, NJ	0039756	UPGRADIENT AREA 15.
BAXTER HEALTHCARE CORPORATION	551 RARITAN CENTER PARKWAY EDISON, NJ	0186375	UPGRADIENT AREA 15.
BUILDING #503	RARITAN CENTER EDISON, NJ	0097338	WITHIN AREA 9.
BUILDING 410	NORTHFIELD AVE. EDISON, NJ	0087005	WITHIN AREA 10, UPGRADIENT AREA 19 AND 9.
BUILDING 440	NORTHFIELD AVE., RARITAN CTR. EDISON, NJ	0100243	LOCATION UNKNOWN.
BUILDING 502	NEWFIELD AVE., RARITAN CENTER EDISON, NJ	0264260	LOCATION UNKNOWN.
BUILDING 520	SUNFIELD AVE., RARITAN CENTER EDISON, NJ	0264251	LOCATION UNKNOWN BELIEVE BUILDING 520 DEMOLISHED AND REPLACED BY EXPO HALL.
CAMPUS PLAZA 4	300 RARITAN CENTER PARKWAY EDISON, NJ	0079987	WITHIN AREAS 2 AND 3
CAPITAL BAKERS DIV. STROEHMANN	440 RARITAN CENTER EDISON, NJ	0022196	LOCATION UNKNOWN.
CENTER REALTY	BUILDING 420 RARITAN CENTER INDUSTRIAL PARK EDISON, NJ	0018713	LOCATION UNKNOWN.

TABLE 6-5 (continued)

SUMMARY OF REGISTERED UNDERGROUND STORAGE TANKS
WITHIN THE FORMER ARSENAL
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SITE NAME	STREET ADDRESS	UST NUMBER	COMMENTS
CONSUMERS DISTRIBUTING INC.	120 NORTHFIELD AVE. EDISON, NJ	0189020	WITHIN AREA 10, UPGRADIENT AREAS 19 AND 9.
EDISON FOAM PROCESSING	521 SUNFIELD AVE., RARITAN CENTER EDISON, NJ	0106733	WITHIN AREA 19, DOWNGRADIENT AREA 9, UPGRADIENT AREA 8.
FEDERAL EXPRESS CORPORATION	305 CLEARVIEW AVE., RARITAN CENTER EDISON, NJ	0146856	SIDEGRADIENT AREA 15, UPGRADIENT AREA 14.
FEDERAL STORAGE WAREHOUSES	BUILDING 436 EDISON, NJ	189750	WITHIN AREA 19, DOUNWGRADIENT AREA 1.
FLAGSHIP-RCA	523 RARITAN CENTER PARKWAY EDISON, NJ	0235875	WITHIN AREA 19, UPGRADIENT AREA 8.
FLEET MAINTENANCE CENTER	350 RARITAN CENTER PARKWAY EDISON, NJ	0041799	PSE&G FLEET MAINTENANCE FACILITY, WITHIN AREA 7.
GARDEN STATE BUILDINGS	BUILDING #518 - RARITAN CENTER EDISON, NJ	0097301	WITHIN AREA 19,DOWNGRADIENT AREA 9.
GARDEN STATE BUILDINGS	BUILDING #520 - RARITAN CENTER EDISON, NJ	0097310	LOCATION UNKNOWN BELIEVE BUILDING DEMOLISHED AND REPLACED BY EXPO HALL.
HELISTOP & PESTICIDE WAREHOUSE	MARC RD., RARITAN CENTER EDISON, NJ	0069348	WITHIN AREA 16, UPGRADIENT AREA 11.
HOLIDAY INN AT RARITAN CENTER	125 RARITAN CENTER PLAZA EDISON, NJ	0168843	UPGRADIENT LOCATION.
MACY'S RARITAN	10 CLEARVIEW RD. EDISON, NJ	0125066	UPGRADIENT AREA 15.

TABLE 6-5 (continued)

SUMMARY OF REGISTERED UNDERGROUND STORAGE TANKS
WITHIN THE FORMER ARSENAL
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SITE NAME	STREET ADDRESS	UST NUMBER	COMMENTS
MIDDLESEX COUNTY COLLEGE	155 MILL RD. EDISON, NJ	0119829	EXACT LOCATION WITHIN COLLEGE UNKNOWN.
MR. JOHN PORTABLE SANITATION	450 RARITAN CENTER EDISON, NJ	0033329	WITHIN AREA 8, DOWNGRADIENT AREA 20.
PARKWAY-KEN CORD.	BUILDING 802, RARITAN CENTER EDISON, NJ	0228738	SIDEGRADIENT AREAS 19, 20, AND 2, UPGRADIENT AREA 7.
PRINCETON AQUA SCIENCE	165 FIELDCREST AVE. EDISON, NJ	0097329	DOWNGRADIENT BUILDING 151 AOC, UPGRADIENT AREA 2.
RARITAN BUILDING ASSOC. LP.	121 FIELDCREST AVE. EDISON, NJ	0136857	UPGRADIENT BUILDING 151 AOC AND AREAS 2 AND 3.
RARITAN PERIODICAL SALES	125 CLEARVIEW AVE. EDISON, NJ	0031169	SIDEGRADIENT AREA 15, UPGRADIENT AREA 14.
RARITAN PLAZA I	RARITAN PLAZA I EDISON, NJ	0097158	UPGRADIENT LOCATION.
RARITAN PLAZA III	RARITAN PLAZA III EDISON, NJ	0097149	UPGRADIENT LOCATION.
SALWEN PAPER COMPANY, INC.	151 FIELDCREST AVE. EDISON, NJ	0190352	WITHIN BUILDING 151 AOC, UPGRADIENT AREAS 2 AND 3.
SUPERMARKETS GENERAL	PARKWAY PLAZA, RARITAN CENTER EDISON, NJ	0213969	LOCATION UNKNOWN.
THE STOP & SHOP CO., INC.	10 CLEARVIEW RD. EDISON, NJ	0003377	UPGRADIENT AREA 15.

TABLE 6-5 (continued)

SUMMARY OF REGISTERED UNDERGROUND STORAGE TANKS
WITHIN THE FORMER ARSENAL
FORMER RARITAN ARSENAL
EDISON, NEW JERSEY

SITE NAME	STREET ADDRESS	UST NUMBER	COMMENTS
THOMAS A. EDISON COUNTY PARK	MILL RD. 1 W PATROL RD. EDISON, NJ	0127325	EXACT LOCATION WITHIN PARK UNKNOWN.
UNITED PARCEL SERVICE	1 CLOVER PL. RARITAN INDUSTRIAL PARK EDISON, NJ	0015437	SIDEGRADIENT AREA 4, UPGRADIENT AREAS 5 AND 14.
UNITED PARCEL SERVICE	1 CLOVER PL. RARITAN INDUSTRIAL PARK EDISON, NJ	0300214	SIDEGRADIENT AREA 4, UPGRADIENT AREAS 5 AND 14.
USEPA EDISON FACILITY	RARITAN DEPOT	0060211	EXACT LOCATION WITHIN USEPA FACILITY UNKNOWN.
WAKEFEFERN FOOD CORP.	230 RARITAN CENTER PARKWAY EDISON, NJ	0070490	SIDEGRADIENT AREAS 2 AND 19, UPGRADIENT AREAS 20 AND 7.
WILLIAM GRANT AND SONS, INC.	130 FIELDCREST AVE. EDISON, NJ	0049070	UPGRADIENT BUILDING 151 AOC, AND AREAS 3 AND 4.
100 NEWFIELD AVENUE	NEWFIELD AVENUE, RARITAN CENTER EDISON, NJ	0264440	WITHIN AREA 9.
90 NEWFIELD AVENUE	NEWFIELD AVENUE, RARITAN CENTER EDISON, NJ	0262992	WITHIN AREA 9.
104 SUNFIELD AVENUE	RARITAN CENTER EDISON, NJ	0155937	WITHIN AREA 9.
305 CLEARVIEW AVENUE	RARITAN CENTER	0155919	SIDEGRADIENT AREA 15, UPGRADIENT AREA 14.
INLAND CONTAINER CORPORATION	2960 WOODBRIDGE AVE. EDISON, NJ	0009254	UPGRADIENT AREA 18C AND BUILDING 151 AOC.